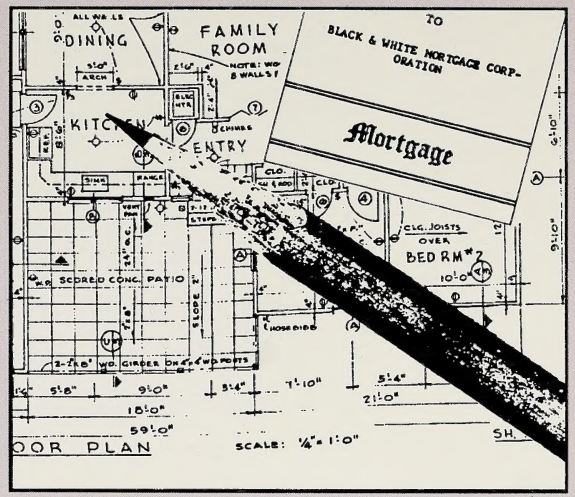
MATHEMATICS 33

Mortgages and Loans



Unit 8

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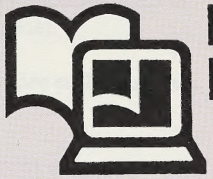

Distance Learning

You have chosen an alternate form of learning that allows you to work at your own pace. You will be responsible for your own schedule, for disciplining yourself to study the units thoroughly, and for completing your units regularly. We wish you much success and enjoyment in your studies.

Mathematics 33 Student Module Unit 8 Mortgages and Loans Alberta Distance Learning Centre ISBN No. 0-7741-0107-5

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General Information

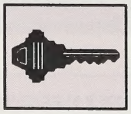
This information explains the basic layout of each booklet.

- **What You Already Know** and **Review** are to help you look back at what you have previously studied. The questions are to jog your memory and to prepare you for the learning that is going to happen in this unit.
- As you begin each **Topic**, spend a little time looking over the components. Doing this will give you a preview of what will be covered in the topic and will set your mind in the direction of learning.
- **Exploring the Topic** includes the objectives, concept development, and activities for each objective. Use your own papers to arrive at the answers in the activities.
- **Extra Help** reviews the topic. If you had any difficulty with **Exploring the Topic**, you may find this part helpful.
- **Extensions** gives you the opportunity to take the topic one step further.
- To summarize what you have learned, and to find instructions on doing the unit assignment, turn to the **Unit Summary** at the end of the unit.
- The **Appendices** include the solutions to **Activities (Appendix A)** and any other charts, tables, etc. which may be referred to in the topics **(Appendix B, etc.)**.

Visual Cues

Visual cues are pictures that are used to identify important areas of the material. They are found throughout the booklet.

An explanation of what they mean is written beside each visual cue.

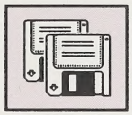


Key Idea
- flagging important ideas

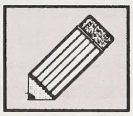
Audiotape
- learning by listening to an audiotape

What You Already Know
- reviewing what you already know

Another View
- exploring different perspectives



Computer Software
- learning by using computer software



Review
- studying previous concepts

Solutions
- correcting the activities

Videotape
- learning by viewing a videotape

Introduction
- introducing the unit

Extra Help
- providing additional study

Print Pathway
- choosing a print alternative

What Lies Ahead
- previewing the unit

Extensions
- going on with the topic

Calculator
- using your calculator

Exploring the Topic
- actively learning new concepts

What You Have Learned
- summarizing what you have learned

Mathematics 33

Course Overview

Mathematics 33 contains 8 units. Beside each unit is a percentage that indicates what the unit is worth in relation to the rest of the course. The units and their percentages are listed below. You will be studying the unit that is shaded.

Unit 1 Powers and Radicals	10%
Unit 2 Polynomials and Rational Expressions	10%
Unit 3 Functions and Relations	16%
Unit 4 Quadratic Functions and Equations	20%
Unit 5 Trigonometry	16%
Unit 6 Statistics	16%
Unit 7 Annuities	6%
Unit 8 Mortgages and Loans	6%
	100%

Unit Assessment

After completing the unit, you will be given a mark based totally on a unit assignment. This assignment will be found in the Assignment Booklet.

Unit Assignment - 100%

If you are working on a CML terminal, your teacher will determine what this assessment will be. It may be

Unit Assignment - 50%
Supervised Unit Test - 50%

Introduction to Mortgages and Loans

This unit covers topics dealing with mortgages and loans. Each topic contains explanations, examples, and activities to assist you in understanding mortgages and loans. If you find you are having difficulty with the explanations and the way the material is presented, there is a section called **Extra Help**. If you would like to extend your knowledge of the topic, there is a section called **Extensions**.

You can evaluate your understanding of each topic by working through the activities. Answers are found in the solutions in **Appendix A**. In several cases there is more than one way to do the question.

Unit 8 Mortgages and Loans

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Value	**Mortgages and Loans**	3
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35%	**Topic 1:** Loans	7
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65%	**Topic 2:** Mortgages	29
	• Introduction • Extra Help • What Lies Ahead • Extensions • Exploring Topic 2	
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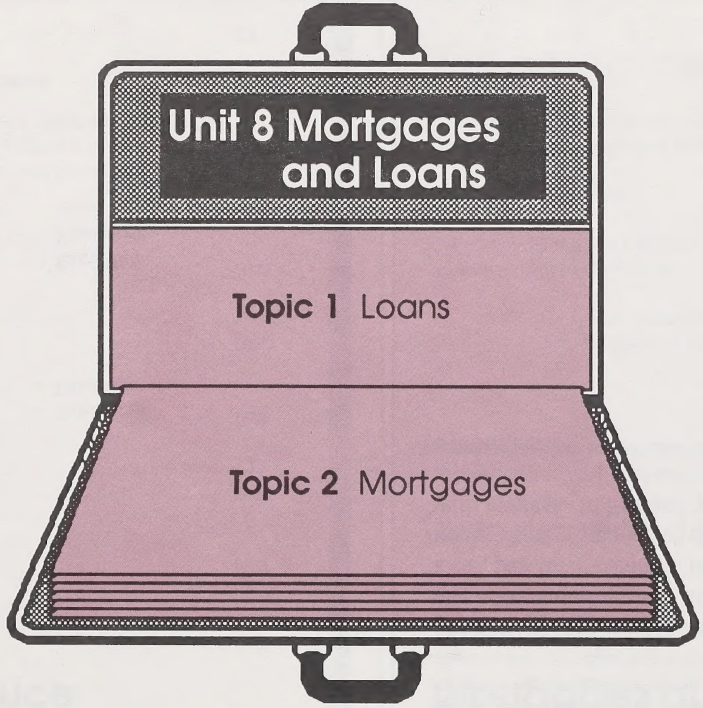
Mortgages and Loans

Most people approach a lending institution to apply for some sort of loan during their lifetime. This loan may be used to buy a car, pay for a vacation, pay for unexpected bills, or purchase a home. Loans are nice to obtain but they must be repaid, always with interest. In this unit you will study loans and loan repayment. You will also look into a special kind of loan called a mortgage.


Unit 8 Mortgages and Loans
Topic 1 Loans
Topic 2 Mortgages

What You Already Know

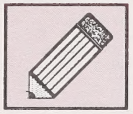
You should be able to do the following.

- Calculate simple interest by using the following formula:

  $I = Prt$, where I = amount of interest
  P = principal
  r = rate of interest per year
  t = time in years

- Multiply and divide whole numbers, decimal numbers, and fractions by mental calculation, paper and pencil calculation, or with a calculator.

Do the following review exercises.



Review

1. Calculate the simple interest on each amount which follows.

   a. \$500 at 12%/a for 3 years

   b. \$850 at $13\frac{1}{2}$%/a for 11 months

   c. \$1150 at $12\frac{3}{4}$%/a for 68 days

12%/a means 12% per annum or 12% per year. When the interest rate is per year, the time must also be in years.

2. Use your calculator to evaluate each number expression which follows.

   a. $350 \times 0.083 \times \frac{2}{3}$

   b. $780 \times 0.123 \times \frac{43}{75}$

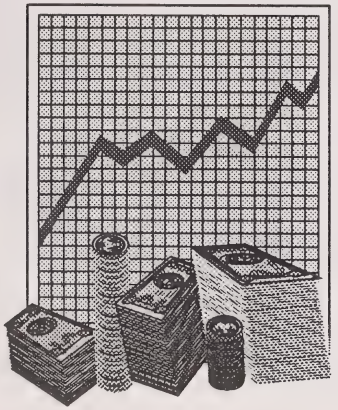
   c. $\frac{3}{17} \times 1.732 \times 156.50$

Now go to the **Review** solutions in **Appendix A**.

Topic 1 Loans

Introduction

As stated earlier, a loan is money borrowed in order to buy something that you want, but this loan has to be repaid, always with interest. How do banks and other lending institutions determine how much has to be repaid? What factors determine the amount that has to be repaid? In this topic you will be given the answers to the above questions. Read on and learn about loan payments.



What Lies Ahead

Throughout the topic you will learn to

1. calculate loan payments

Now that you know what to expect, turn the page to begin your study of loans.

Exploring Topic 1

Activity 1

Calculate loan payments.

If you have a good credit rating, most banks and lending institutions will gladly give you a loan. This loan may be used to purchase a vehicle, go on a vacation, or pay for unplanned expenses. When banks give you a loan, they are in fact letting you use their money. This money will have to be repaid along with a user's fee. This user's fee is determined by charging a percentage of the amount of the loan.

This percentage is called the **interest** rate on the loan.

When you repay a loan, you repay the original amount of the loan plus the interest on the loan. The amount of interest paid on a loan is determined by the following four factors:

- the amount of the loan
  The amount of the loan is commonly called the **principal**. The larger the principal, the more interest you will pay.
- the interest rate of the loan
  The interest rate is expressed as a percentage of the loan. The higher the interest rate, the more interest you will pay. Interest rates may be stated as monthly, weekly, or daily. For loans interest rates are usually quoted as a percentage per year.
- the time in which the loan is to be repaid
  The longer the repayment time, the more interest you will have to pay. For loans time is usually expressed in terms of years.
- the number of payments or the frequency of payments
  In most cases the more frequent your payments are, the less interest you will pay.

You will see how these factors determine the total amount repayable on a loan.

When you visit a bank or some other lending institution, you will find a variety of loans available. Some loans are repaid as a single lump sum while others require multiple payments spread out evenly over the term of the loan. The amount of money you intend to borrow will determine whether you need a short-term loan or a long-term loan.

Banks generally consider any loan that is paid back in less than one year as a short-term loan. A loan that is paid back in one to five years is a mid-term loan, and any loan that is paid back in five years or longer is a long-term loan.

If you intend to borrow a small amount of money, a short-term loan may be what you want. Many short-term loans are paid off as a single lump sum at the end of the term.

When you repay a loan, you must repay the original loan amount plus any interest. To find the interest, you use the following formula.

$I = Prt$, where I = interest
P = principal of the loan
r = annual rate of interest
t = term of the loan in years

Look at the following example to see how to find the interest on a loan and the total amount repayable on a loan.

Example 1

Ahmed Mustapha obtained a $1250.00 loan at 12% per annum from the bank. The loan is to be paid back as a lump sum at the end of one year.

- Find the interest charged.

Solution:

The interest can be found by using the formula $I = Prt$.

$I = ?,\ P = \$1250.00,\ r = 12\% = 0.12,\ t = 1$ year

$I = \$1250.00 \times 0.12 \times 1$

$I = \$150.00$

The interest amounts to $150.00.

The term of a loan refers to the time within which the loan is to be repaid.

Per annum means per year.

When using the formula $I = Prt$, express the rate as a ratio or a decimal. Therefore, 12% can be expressed as $\frac{12}{100}$ or 0.12.

- Find the total amount Ahmed would pay in order to dispose of the loan.

Solution:

The total amount Ahmed would pay would be the sum of the original principal and the interest. Use the formula $A = P + I$.

A = total amount, P = principal, I = interest

$A = \$1250.00 + \$150.00$ (if $A = ?$, $P = \$1250.00$, $I = \$150.00$)

$A = \$1400.00$

Ahmed would pay \$1400.00 to dispose of the loan.

To dispose of a loan means to pay off a loan in full.

Quite often loans are taken out for several months. Look at the next example that deals with this situation.

Example 2

Tracey Nakai obtained a bank loan for \$550.00 at $12\frac{1}{2}$%/a, to be paid back as a single lump sum at the end of seven months.

- Calculate the interest Tracey would pay.

Solution:

Use $I = Prt$ where $I = ?$, $P = \$550.00$, $r = 12\frac{1}{2}\% = 0.125$, and $t =$ seven months or $\frac{7}{12}$ years.

$$I = \$550.00 \times 0.125 \times \frac{7}{12}$$

$I = \$40.10$ (rounded to the nearest cent)

The interest amounts to \$40.10.

In the formula $I = Prt$ the time must be in years if the interest rate is expressed per year.

- Calculate the total amount that Tracey would pay to dispose of the loan.

Solution:

The total amount payable is found by using the formula $A = P + I$.

$$A = \$550.00 + \$40.10$$
$$= \$590.10$$

The total amount that Tracey would pay to dispose of the loan is \$590.10.

There are also situations in which you may want to obtain a loan for a certain number of days. Look at the next example.

Example 3

A short-term bank loan for \$780.00 at $13\frac{3}{4}$%/a is to be repaid at the end of 175 days as a lump sum.

- Find the interest.

Solution:

Use $I = Prt$, where $I = ?$, $P = \$780.00$, $r = 13\frac{3}{4}\% = 0.1375$, and $t = 175$ days or $\frac{175}{365}$ years.

$$I = \$780.00 \times 0.1375 \times \frac{175}{365}$$
$$I = \$51.42 \quad \text{(rounded to the nearest cent)}$$

The interest payable is \$51.42.

Express the number of days in terms of years. Banks consider a year to be 365 days.

- Find the total amount payable at the end of 175 days.

  Solution:

  The total amount payable is $A = P + I$.

  $A = \$780.00 + \$51.42$

  $A = \$831.42$

  The total amount is \$831.42.

The preceding three examples all involved a relatively small amount of money. Since the loans were small, they could be paid back as a single lump sum. What would happen if you decided to obtain a loan of \$20 000.00 from your bank? In most cases it would be impossible to pay back this amount as a single lump sum. Also, for most people, it would be impossible to repay this amount in a short period of time.

To obtain a large loan, banks and other lending institutions will require that you make multiple payments spread out evenly over a specified period of time. For example, a loan of \$20 000.00 could be paid back, with interest, if you made monthly payments of \$287.00 for 10 years. These regular payments may be weekly, monthly, quarterly, semiannually, or even yearly. Most people prefer to make monthly payments on their loan since they themselves usually get paid monthly.

The period of time (term of the loan) that you select to make your regular payments depends on several factors. If you decide to extend your payments over a longer period of time, your regular payments will be smaller, but the total amount repayable will be larger due to the interest charged during this additional time.

If you decide to make your payments over a shorter period of time, you will save on interest charges, but your regular monthly payments may be quite a bit larger. The time that you choose to pay back a loan should be as short as possible in order to save on interest charges, but the regular payments should not be so large that they would interfere with your normal day-to-day living. In most cases your banker will look at your personal and financial situation and advise you as to how large your monthly payments should be. This decision is based on your anticipated future needs as well as your current situation. The following chart is a comparison showing the possibilities for the repayment of a \$30 000.00 loan at $12\frac{1}{2}$%/a.

Quarterly means four times per year or every three months.

Semiannually means twice a year or every six months.

Period of Repayment	Amount of Monthly Payment	Total Interest Charged on the Loan
$30 000.00 repaid over five years	$670.20	$10 212.00
$30 000.00 repaid over ten years	$433.80	$22 056.00
$30 000.00 repaid over twenty years	$334.50	$50 280.00

This chart shows the relationship between the period of repayment, the amount of the monthly payment, and the total interest charged on the loan. You can see that the shorter the repayment period, the larger the monthly payment and the smaller the total interest charged. If you choose a longer period of repayment, you will pay less per month, but the total interest charged may be quite large. In deciding how to repay a loan you should be aware of these relationships.

In repaying a loan there are two payment options that are available.

Option 1: Nonblended Payments

In repaying a loan using nonblended payments your monthly payment consists of two parts. The first part of your payment is an amount which reduces the principal of the loan. The second portion of your payment is the interest. The portion of your payment that reduces the principal is constant for the life of the loan. The portion that pays the interest decreases with each payment made.

The amount of interest that is paid at the beginning of each month is calculated on the balance at the end of the previous month. As the total amount of the principal is reduced, the interest payable will also be reduced. For this reason nonblended loan payments are not the same amount from month to month. The first payment is always the largest with each succeeding monthly payment becoming smaller.

The table which follows shows a repayment schedule for a $3600.00 loan at 12%/a payable in twelve nonblended monthly payments.

A table like this is called an **Amortization Table**.

Payment Number	Balance Owing	Amount Paid to Principal	Amount of Interest Paid	Total Payment	Outstanding Balance
1	$3600.00	$300.00	$36.00	$336.00	$3300.00
2	$3300.00	$300.00	$33.00	$333.00	$3000.00
3	$3000.00	$300.00	$30.00	$330.00	$2700.00
4	$2700.00	$300.00	$27.00	$327.00	$2400.00
5	$2400.00	$300.00	$24.00	$324.00	$2100.00
6	$2100.00	$300.00	$21.00	$321.00	$1800.00
7	$1800.00	$300.00	$18.00	$318.00	$1500.00
8	$1500.00	$300.00	$15.00	$315.00	$1200.00
9	$1200.00	$300.00	$12.00	$312.00	$ 900.00
10	$ 900.00	$300.00	$ 9.00	$309.00	$ 600.00
11	$ 600.00	$300.00	$ 6.00	$306.00	$ 300.00
12	$ 300.00	$300.00	$ 3.00	$303.00	$ 0.00

From the preceding table you can see that

- the total monthly payment is not constant
- the amount paid toward the principal is the same every month
- the amount of interest paid per month decreases with each payment

Now that you know what an amortization table looks like, study the following example to learn how to make your own table.

Example 4

Anders Hansen obtained a loan for $6000.00 at 14% per annum. He agreed to repay the principal of the loan, plus interest calculated on the outstanding balance, in four equal semiannual payments over two years. Make an amortization table that shows Anders' payments.

Semiannual means every six months.

Solution:

If $6000.00 is to be repaid in four equal payments, then
$6000.00 \div 4 = \$1500.00$ must be the amount of principal that is repaid with every payment.

Interest can be calculated by using the formula $I = Prt$.

For the first payment:

The amount of principal to be paid is $1500.00.

The amount of interest to be paid is found by using the formula $I = Prt$.

$I = Prt$, where $I = ?$, $P = \$6000.00$, $r = 14\% = 0.14$, and $t = 6 \text{ months} = \frac{6}{12}$ year or $\frac{1}{2}$ year

$I = \$6000.00 \times 0.14 \times \frac{1}{2}$

$I = \$420.00$

The interest charge on the first payment is $420.00. Therefore, the total amount of the first payment is $\$1500.00 + \$420.00 = \$1920.00$.

For the second payment:

The amount of principal to be paid is \$1500.00.

The interest to be paid is found by using the formula $I = Prt$.

$I = Prt$, where $I = ?$, $P = \$6000.00 - \$1500.00 = \$4500.00$,

$r = 14\% = 0.14$, and $t = 6 \text{ months} = \frac{1}{2} \text{ year}$

$I = \$4500.00 \times 0.14 \times \frac{1}{2}$

$I = \$315.00$

The interest portion of the second payment is \$315.00.

The total amount of the second payment is $\$1500.00 + \$315.00 = \$1815.00$.

For the third payment:

The amount of principal to be paid is \$1500.00.

The interest to be paid is $I = Prt$.

$I = Prt$, where $I = ?$, $P = \$4500.00 - \$1500.00 = \$3000.00$,

$r = 14\% = 0.14$, and $t = \frac{1}{2} \text{ year}$

$I = \$3000.00 \times 0.14 \times \frac{1}{2}$

$I = \$210.00$

The amount of interest paid is \$210.00.

The total amount of the third payment is $\$1500.00 + \$210.00 = \$1710.00$.

For the fourth, or final, payment:

The amount of principal to be paid is \$1500.00.

The interest to be paid is $I = Prt$.

$I = Prt$, where $I = ?$, $P = \$3000.00 - \$1500.00 = \$1500.00$,

$r = 14\% = 0.14$, and $t = \frac{1}{2}$ year

$I = \$1500.00 \times 0.14 \times \frac{1}{2}$

$I = \$105.00$

The amount of interest paid is \$105.00.

The total amount of the fourth payment is \$1500.00 + \$105.00 = \$1605.00.

The previous information can be put into an amortization table as shown.

Payment Number	Balance Owing	Amount Paid on Principal	Amount of Interest Paid	Total Payment	Outstanding Balance
1	\$6000.00	\$1500.00	\$420.00	\$1920.00	\$4500.00
2	\$4500.00	\$1500.00	\$315.00	\$1815.00	\$3000.00
3	\$3000.00	\$1500.00	\$210.00	\$1710.00	\$1500.00
4	\$1500.00	\$1500.00	\$105.00	\$1605.00	\$ 0.00

From the preceding table you can see the total amount of each payment, the amount paid on principal, the amount of interest paid, and the outstanding balance.

Option 2: Blended Payments

In repaying a loan using blended payments your payments consist of an amount that reduces the principal of the loan and an amount that pays the interest. The portion of your payment that reduces the principal changes from payment to payment. The portion that reduces the principal on your first payment is a minimum but increases with each succeeding payment. The interest charges also vary from payment to payment. The first payment contains the largest interest charge and each succeeding payment contains less interest. In a blended loan repayment schedule the amount of principal reduction and the amount of interest paid varies from payment to payment, but the total monthly payment is constant for the life of the loan.

The following amortization table shows the first six monthly payments on a $30 000.00 loan at 12%/a, using blended payments for a ten-year period.

Payment Number	Balance Owing	Amount Paid on Principal	Amount of Interest Paid	Total Payment	Outstanding Balance
1	$30 000.00	$130.50	$300.00	$430.50	$29 869.50
2	$29 869.50	$131.80	$298.70	$430.50	$29 737.70
3	$29 737.70	$133.12	$297.38	$430.50	$29 604.58
4	$29 604.58	$134.45	$296.05	$430.50	$29 470.13
5	$29 470.13	$135.80	$294.70	$430.50	$29 334.33
6	$29 334.33	$137.16	$293.34	$430.50	$29 197.17

From this table you can see that

- the total amount paid each month is constant
- the amount of principal paid increases with each succeeding payment
- the amount of interest paid decreases with each succeeding payment

To see how an amortization table is made using blended payments, look at the next example.

Example 5

The Dubois family intends to repay a $6000.00 loan at 14%/a using blended payments in four equal semiannual payments. If interest is calculated every six months, draw an amortization table to show the payments.

Solution:

If payments are to be blended, banks and other lending institutions use tables of values to calculate the amount of the payment. In order to pay back the $6000.00, the Dubois family's semiannual payments would need to be $1771.37 (obtained from a table).

To make an amortization table, you need to calculate the interest and principal portions on each payment of $1771.37. Interest is calculated by using the formula $I = Prt$.

For the first payment:

$I = Prt$, where $I = ?$, $P = \$6000.00$, $r = 14\% = 0.14$, and $t = \frac{6}{12}\text{ year} = \frac{1}{2}\text{ year}$

$$I = \$6000.00 \times 0.14 \times \frac{1}{2}$$

$$I = \$420.00$$

Since $420.00 of the $1771.37 payment is used to pay interest,
then $\$1771.37 - \$420.00 = \$1351.37$ is the amount that will reduce the principal.

For the second payment:

$I = Prt$, where $I = ?, P = \$6000.00 - \$1351.37 = \$4648.63$,

$r = 0.14$, and $t = \frac{1}{2}$ year

$I = \$4648.63 \times 0.14 \times \frac{1}{2}$

$I = \$325.40$

Since \$325.40 of the \$1771.37 is used to pay interest,
then $\$1771.37 - \$325.40 = \$1445.97$ is the amount used to reduce the principal.

For the third payment:

$I = Prt$, where $I = ?, P = \$4648.63 - \$1445.97 = \$3202.66$,

$r = 0.14$, and $t = \frac{1}{2}$ year

$I = \$3202.66 \times 0.14 \times \frac{1}{2}$

$I = \$224.19$

Since \$224.19 of the \$1771.37 is used to pay interest,
then $\$1771.37 - \$224.19 = \$1547.18$ is the amount used to reduce the principal.

Note: The principal for the second payment is equal to the principal of the first payment less the amount of reduction of the first payment.

For the fourth, or final, payment:

$I = Prt$, where $I = ?$, $P = \$3202.66 - \$1547.18 = \$1655.48$,

$r = 0.14$, and $t = \frac{1}{2}$ year

$I = \$1655.48 \times 0.14 \times \frac{1}{2}$

$I = \$115.88$

Since \$115.88 of your \$1771.37 payment is used to pay interest,
then the amount of principal paid is $\$1771.37 - \$115.88 = \$1655.49$.

The preceding information can be put into an amortization table such as the following.

Payment Number	Balance Owing	Amount Paid on Principal	Amount of Interest Paid	Total Payment	Outstanding Balance
1	\$6000.00	\$1351.37	\$420.00	\$1771.37	\$4648.63
2	\$4648.63	\$1445.97	\$325.40	\$1771.37	\$3202.66
3	\$3202.66	\$1547.18	\$224.19	\$1771.37	\$1655.48
4	\$1655.48	\$1655.49	\$115.88	\$1771.37	\$ 0.00

The total amount of principal repaid from the third column is \$6000.01.

The total amount of interest paid from the fourth column is \$1085.47.

From the table you can easily tell what portion of the regular payment goes to repaying the principal and what portion goes to paying the interest.

The \$0.01 difference is due to rounding. An adjustment for this amount would be made on the last payment.

An advantage of blended payments over nonblended payments is that each payment is for the same amount. Many people like this because it is easier to budget for a constant loan payment. A disadvantage of blended payments is that you pay slightly more in interest charges.

As stated earlier, if a loan is to be repaid using blended payments, then bankers and other money lenders use a table to determine the amount of the payment. A portion of such a table follows. The table shows the monthly payment needed to repay a loan of $1000.00. The left-hand column shows the frequency of payment (in terms of months), and the top row shows the annual interest rate. (Interest is calculated on a monthly basis.)

If you are interested in knowing how such a table is determined, go to the **Extensions** section at the end of this topic.

Monthly Payment for a Loan of $1000.00
(including principal and interest)

Interest Rates	12%	$12\frac{1}{8}$%	$12\frac{1}{4}$%	$12\frac{3}{8}$%	$12\frac{1}{2}$%	$12\frac{5}{8}$%	$12\frac{3}{4}$%	$12\frac{7}{8}$%
Terms in Months								
1	1010.000	1010.104	1010.208	1010.312	1010.417	1010.521	1010.625	1010.729
2	507.512	507.591	507.669	507.748	507.826	507.904	507.983	508.061
3	340.022	340.092	340.162	340.232	340.302	340.372	340.442	340.512
4	256.281	256.347	256.413	256.478	256.544	256.610	256.676	256.742
5	206.040	206.103	206.166	206.230	206.293	206.357	206.420	206.483
6	172.548	172.610	172.672	172.734	172.796	172.857	172.919	172.981
7	148.628	148.689	148.750	148.810	148.871	148.932	148.993	149.054
8	130.690	130.750	130.810	130.870	130.930	130.990	131.050	131.110
9	116.740	116.800	116.859	116.919	116.978	117.038	117.097	117.157
10	105.582	105.641	105.700	105.759	105.818	105.877	105.936	105.995
11	96.454	96.513	96.572	96.630	96.689	96.748	96.807	96.865
12	88.849	88.907	88.966	89.024	89.083	89.141	89.200	89.259
13	82.415	82.473	82.531	82.590	82.648	82.707	82.765	82.824
14	76.901	76.959	77.018	77.076	77.134	77.192	77.251	77.309
15	72.124	72.182	72.240	72.298	72.357	72.415	72.473	72.531
16	67.945	68.003	68.061	68.119	68.177	68.235	68.294	68.352
17	64.258	64.316	64.374	64.432	64.491	64.549	64.607	64.665
18	60.982	61.040	61.098	61.156	61.215	61.273	61.331	61.389
19	58.052	58.110	58.168	58.226	58.284	58.343	58.401	58.459
20	55.415	55.473	55.532	55.590	55.648	55.706	55.765	55.823
21	53.031	53.089	53.147	53.205	53.264	53.322	53.380	53.439
22	50.864	50.922	50.980	51.039	51.097	51.155	51.214	51.272
23	48.886	48.944	49.003	49.061	49.119	49.178	49.236	49.295
24	47.073	47.132	47.190	47.249	47.307	47.366	47.424	47.483
25	45.407	45.465	45.524	45.582	45.641	45.700	45.758	45.817

Note: A more complete set of loan repayment tables can be found in **Appendix B**.

You may use the preceding table to find the blended monthly payment on a loan, and from this payment you can calculate the total interest charges. The next example shows how this is done.

Example 6

Jody Einfeld wishes to repay a \$15 000.00 loan at $12\frac{1}{2}$%/a in eighteen monthly payments.

- Find the amount she must pay each month.

  Solution:

  The loan is at $12\frac{1}{2}$%/a for eighteen months. You find $12\frac{1}{2}$% in the top row and eighteen months in the first column. The intersection of this row and column gives a value of \$61.215. This means that to repay a loan of \$1000.00 in eighteen months when the interest rate is $12\frac{1}{2}$%/a, Jody would have to make monthly payments of \$61.215. Since \$15 000.00 is fifteen times as large as \$1000.00, the monthly payment would be fifteen times as large. The monthly payment would be $\$61.215 \times 15 = \$918.23$ (rounded to the nearest cent).

- Find the total amount she repays.

  Solution:

  Since there are eighteen payments, the total amount repaid would be $18 \times \$918.23 = \$16\ 528.14$.

- Find the amount of interest that Jody pays on this loan.

  Solution:

  The amount of interest paid would be $\$16\ 525.14 - \$15\ 000.00 = \$1528.14$.

Now it is time to apply what you have learned to some questions. Do the following exercises.

1. How do lending institutions make money when they offer loans?

2. What four factors determine the amount of interest that you pay on a loan?

3. Determine the lump-sum payment required to repay the following loans. Do any three. Where necessary round the answers to the nearest cent. Use your calculator wherever possible.

   a. \$800.00 loan at 14.25%/a for one year

   b. \$650.00 loan at 13.75%/a for five months

   c. \$1250.00 loan at 11.72%/a for sixty-eight days

   d. \$2200.00 loan at 11%/a for nine months

   e. \$975.00 loan at 12.35%/a for 115 days

4. In repaying a long-term loan using monthly payments, explain how the period of time in which the loan is to be repaid affects the size of the monthly payment and the total amount of interest paid.

5. If you had a low-paying job and needed a loan of $30 000, would you repay this loan over a short period of time or a long period of time? Give a reason for your answer.

6. In regards to nonblended monthly payments, which of the following is constant for every payment?

   A. the amount paid on the principal

   B. the amount of interest paid

   C. the total amount paid per month

   D. none of the above

   E. all of the above (A to C)

7. Make an amortization table to show how a loan is repaid in nonblended payments. Do a or b or both.

   a. A $2100.00 loan at 18%/a is to be repaid in three equal monthly payments.

   b. A $3300.00 loan at 15%/a is to be repaid in three equal monthly payments.

8. In making blended monthly payments, which of the following is constant for every payment?

   A. the amount paid on the principal

   B. the amount of interest paid

   C. the total amount paid per month

   D. none of the above

   E. all of the above (A to C)

Note: The time in problems 7a and 7b would be one month or $\frac{1}{12}$ year.

9. Make an amortization table to show the first three payments on the following loans, using blended payments. Interest is calculated on a monthly basis. Do a or b or both.

   a. A loan of $30 000.00 at 12%/a is to be repaid over a period of twenty years by making monthly payments of $330.30.

   b. A loan of $25 000.00 at 18%/a is to be repaid over a period of ten years by making monthly payments of $450.50.

10. Using the monthly payment tables in **Appendix B**, calculate the monthly payment required to repay the following loans (to the nearest cent). Do any three.

    a. $15 000 at $10\frac{5}{8}$%/a over thirty months

    b. $27 000 at $12\frac{3}{4}$%/a over five years

    c. $15 700 at $11\frac{1}{2}$%/a over fifty months

    d. $17 500 at 12%/a over three years

    e. $36 300 at $10\frac{1}{2}$%/a over four years

11. For any two of the following questions, find the following information:

    - the monthly payment needed
    - the total amount repaid
    - the total amount of interest paid

    Round all answers to the nearest cent.

    a. Ray Danyluk intends to repay a $22 000.00 loan at $11\frac{1}{4}$%/a over forty-two months.

    b. Kimberley Heemstra plans to repay an $18 000.00 loan at $12\frac{1}{2}$%/a over five years.

    c. Jason Sakakibara will repay a $32 000.00 loan at 12%/a over seven years.

For solutions to **Activity 1**, turn to **Appendix A, Topic 1**.

If you require help, do the Extra Help section.

If you want more challenging explorations, do the Extensions section.

} You may decide to do both.

Extra Help

If you have some difficulty reading monthly loan payments from a table, you may benefit from this section.

Most banks will gladly give you your own Monthly Loan Payment Calculator. With this loan calculator you can easily determine the monthly payments on any loan if you know the interest rate and the term of the loan.

If you do not have access to a bank, you can make your own Monthly Loan Payment Calculator. See **Appendix B** for instructions on how to make your own calculator.

The reading that you see in the window of the loan payment calculator is the amount of the monthly payments needed to repay a loan of $1000. The small window shows the annual interest rate and the number above the long window shows the period of time in which the loan is to be repaid.

Using your Monthly Loan Payment Calculator, find the monthly payment on each of the following loans.

1. $5000 loan at $12\frac{1}{2}$%/a for ten years

2. $15 000 loan at 11%/a for twenty years

3. $23 000 loan at 12%/a for five years

For solutions to **Extra Help**, turn to **Appendix A, Topic 1**.

Extensions

Have you ever wondered how the values in loan repayment tables are calculated? Most banks develop these tables using computers, but there is also a formula that you may use to find these values. The following formula can be used to find the blended monthly payment on a loan if interest is calculated on a monthly basis.

$$R = \frac{Pi}{1-(1+i)^{-n}}$$, where R = regular monthly payment

P = principal of the loan

i = interest rate per payment

n = total number of payments made to pay off a loan

To see how this formula works, examine the following example.

Example 7

Jill Sandhu wishes to repay a $20 000 loan at 15%/a over ten years. Calculate the amount of the monthly payments she must make.

Solution:

$$R = \frac{Pi}{1-(1+i)^{-n}}$$, where R = ?

P = \$20 000

$i = 15\% \div 12 = 1.25\%$, since the yearly rate of interest is 15% and the interest rate per monthly payment is $15\% \div 12$

$n = 12 \times 10 = 120$, which is the total number of payments

Now substitute these values into the formula.

$$R = \frac{20\,000 \times 0.0125}{1-(1+0.0125)^{-120}} \quad \text{(Note: } 1.25\% = 0.0125\text{)}$$

$$R = \frac{250}{1-(1.0125)^{-120}}$$

Find $(1.0125)^{-120}$.

Enter	Display
1.0125	1.0125
x^y	1.0125
120	120
+/-	− 120
=	0.225214409

$$R = \frac{250}{1 - 0.225\,214\,409}$$

$$R = \frac{250}{0.774\,785\,59}$$

$$R \doteq 322.67$$

The monthly payment would be $322.67 (to the nearest cent).

Try the following questions.

Using the preceding formula, calculate to the nearest cent the monthly payment needed to repay each of the following loans. You may verify your answers by using the loan tables in **Appendix B**. The answers will vary slightly due to the fact that the values in the loan tables represent rounded values. The values obtained by using the formula are more exact.

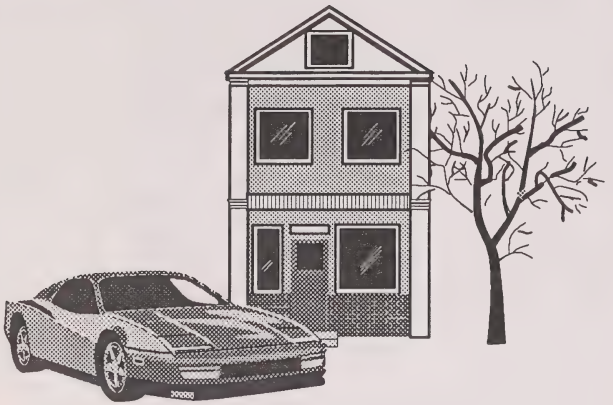
1. $17 000 loan at 12%/a over five years

2. $25 000 loan at 10%/a over seven years

For solutions to **Extensions**, turn to **Appendix A, Topic 1**.

Topic 2 Mortgages

Introduction



The largest investment that most people make is the purchase of a house. Most people will require a special type of loan called a **mortgage** to pay for their house. In this topic you will learn more about mortgages and mortgage payments.

What Lies Ahead

Throughout the topic you will learn to

1. calculate mortgage payments

Now that you know what to expect, turn the page to begin your study of mortgages.

Exploring Topic 2

Activity 1

Calculate mortgage payments.

Suppose you just obtained a loan for $100 000 at an interest rate of 13%/a to purchase your dream home. If you decide to repay this loan by making monthly payments for the next twenty-five years, how much interest will you pay? The answer to this question is quite shocking!

To repay this loan you would be required to pay $230 600 in interest, assuming the interest rate is constant for twenty-five years.

Many houses in urban areas are selling for amounts in excess of $100 000. Most people do not have large sums of money like this at their disposal. Therefore, in order to purchase a house for this amount, they would need a loan. To borrow a large amount of money such as $100 000, a long-term loan is usually necessary.

A long-term loan that is used to purchase property when the property is used as collateral is called a **mortgage**.

Most mortgages are for ten, twenty, twenty-five, or thirty years. A twenty-five-year mortgage means that the mortgage has to be repaid in twenty-five years.

Before banks and other lending institutions give you a mortgage, they require that security or collateral be provided. This security is usually the property being purchased. If you fail to make payments on your mortgage, the bank has the right to take possession of your house. The bank even has the right to sell your house or property to repay the mortgage against it.

In Topic 1 of this unit you studied loans. A mortgage is a special type of loan. Examine the comparisons shown in the following table to see how loans and mortgages differ and how they are similar.

Loans	Mortgages
• Most loans are short-term or mid-term. Loans are usually from one day to five years in length.	• Mortgages are long-term, from five to thirty years. Most mortgages are between twenty and thirty years in length.
• Most loans involve smaller sums of money, usually less than $20 000.	• Most mortgages involve larger sums of money, usually greater than $20 000.
• If you have a good credit rating, then many loans do not require security.	• Mortgages require that security be provided. This security is usually the property being purchased.
• The interest on most loans is calculated on a monthly basis.	• The interest on mortgages is always calculated semiannually. This is the law in Canada.
• Loans are usually repaid with a lump-sum payment or monthly payments.	• Most mortgages require that payments be made monthly.
• Loans are obtained to purchase items such as a car, a trailer, or a vacation.	• Mortgages are usually used to purchase real estate such as a house, a business place, or land.

Before you are shown how to calculate monthly mortgage payments, you should become familiar with the terminology related to a mortgage. The following are some terms that you should become familiar with.

Mortgage: a long-term loan that has property as security or collateral

Amortization period: the length of time within which the mortgage has to be repaid
Most amortization periods for mortgages are between twenty and thirty years.

Term of a mortgage: the length of time, from six months to five years, before the mortgage contract can be renegotiated and when a set interest rate is charged against the principal
Since interest rates fluctuate, bankers are reluctant to give a particular interest rate for the entire amortization period. Instead, they will specify a particular interest rate for a shorter period of time, from six months to five years. The payments during this time will be calculated according to the current interest rate. The term of a mortgage refers to the time within which a set interest rate is in effect. A mortgage may have an amortization period of thirty years, but the term of the mortgage may be no more than five years at a time.

Once the **term of a mortgage** has expired, the entire existing mortgage is due in full.

When the term of a mortgage expires, three options are available.

- Pay off the existing mortgage in full.
- Renew the mortgage by negotiating the length of the next term and the interest rate for this term, and agree to continue to make monthly payments under these latest negotiated conditions.
- Pay off part of the existing mortgage and renew the mortgage by negotiating the length of the next term (as stated in the previous option).

For mortgages, banks and other lending institutions offer a variety of options. Descriptions of some of the more common options follow.

- A **fully open mortgage** is one in which the entire principal or any portion of the principal can be prepaid at any time without penalty.
- A **fully closed mortgage** is one in which no amount can be prepaid. Only the regular monthly payments are allowed. The interest rate for this type of mortgage is usually a little lower than for an open mortgage.
- An **open mortgage with a fixed penalty** is one where any amount can be prepaid, but a penalty will be charged. This penalty is usually three months' interest.
- Blended or nonblended payments may be used to repay a mortgage.

- Interest rates may be fixed for the term of the mortgage (most common), or they may fluctuate for the term of the mortgage.

- Most mortgage payments are made monthly, but banks will also allow you to make payments weekly, biweekly (every two weeks), or semimonthly (twice a month).

- Most banks will allow you to increase your regular payment by ten percent. This option could save you a substantial amount of interest.

Mortgages can be repaid using nonblended payments or blended payments. The majority of people prefer to make blended payments as they prefer the monthly payment to be constant. To calculate the blended monthly payment needed to pay a mortgage, banks will use a table. This table is very similar to the one used to calculate monthly loan payments. If you compare the two tables, you will notice a small difference. This difference is due to the fact that loans usually have their interest calculated on a monthly basis whereas mortgages have their interest calculated semiannually. An example of such a table follows. A more complete table can be found in **Appendix B**.

The amount of the monthly payment is affected by several factors:

- the size of the mortgage
- the interest rate
- the amortization period
- the type of institution that is giving the mortgage
- the length of the term
- the frequency of the payments

Monthly Payments Including Principal and Interest for a Mortgage of $1000

Years	5	10	15	20	25	30	35
Rate (%)							
10	21.15	13.10	10.62	9.52	8.94	8.63	8.44
10 1/4	21.27	13.24	10.77	9.68	9.11	8.80	8.63
10 1/2	21.38	13.37	10.92	9.83	9.28	8.98	8.81
10 3/4	21.50	13.50	11.06	10.00	9.45	9.16	8.99
11	21.62	13.64	11.21	10.16	9.63	9.34	9.18
11 1/4	21.74	13.77	11.36	10.32	9.80	9.52	9.37
11 1/2	21.86	13.91	11.51	10.48	9.97	9.70	9.55
11 3/4	21.98	14.04	11.66	10.65	10.14	9.88	9.74
12	22.10	14.18	11.82	10.81	10.32	10.06	9.93
12 1/4	22.22	14.32	11.97	10.98	10.50	10.25	10.12
12 1/2	22.34	14.46	12.13	11.15	10.68	10.43	10.31
12 3/4	22.46	14.60	12.28	11.31	10.85	10.62	10.50
13	22.59	14.74	12.44	11.48	11.03	10.97	10.69
13 1/4	22.71	14.88	12.59	11.65	11.21	10.99	10.88
13 1/2	22.83	15.02	12.75	11.82	11.36	11.17	11.07
13 3/4	22.95	15.16	12.90	11.99	11.56	11.36	11.26
14	23.07	15.30	13.06	12.16	11.74	11.54	11.45
14 1/4	23.19	15.44	13.22	12.33	11.92	11.73	11.64
14 1/2	23.31	15.58	13.38	12.50	12.10	11.92	11.83
14 3/4	23.44	15.72	13.54	12.67	12.29	12.10	12.02
15	23.56	15.87	13.70	12.84	12.47	12.29	12.21

Note that this table is for a mortgage of $1000.

Look at the next example to see how you can use this table to calculate the monthly payment on a mortgage.

Example 1

Sarah Louis required a mortgage of \$95 000.00 at $12\frac{1}{2}$%/a to purchase a house. If she decided to make monthly payments over twenty-five years, how much would the payment be? Assume that the interest rate is constant for the twenty-five years.

Solution:

Since the mortgage is at $12\frac{1}{2}$%/a for twenty-five years, you must find $12\frac{1}{2}$% in the left column and twenty-five years in the top row. The intersection of this column and row gives a value of \$10.68. This means that \$1000.00 can be repaid in twenty-five years by making monthly payments of \$10.68. To repay \$95 000.00, the monthly payment would need to be 95 times as large or $95 \times \$10.68 = \$1014.60$.

Sarah's monthly payment would be \$1014.60.

Unless otherwise stated, you can assume that the interest rate is constant for the entire amortization period. In reality the interest rate may change each time the mortgage is renewed.

It should also be mentioned that banks will not give you a mortgage for the total value of the property being purchased. Banks will usually require a down payment on the value of the property with the balance to be financed through a mortgage.

Most banks may require a down payment of 10% of the value of the property. The balance can be financed with a mortgage. Study the next example to see how a down payment is calculated.

Example 2

Kyle Warburg agrees to purchase a home for \$120 000.00 at $12\frac{1}{4}$%/a by making monthly payments for thirty years. Before the banks will give him a loan, they require a 10% down payment on the house.

- Find the amount of the down payment.

  Solution:

  $$10\% \text{ of } \$120\,000.00 = 0.10 \times \$120\,000.00$$
  $$= \$12\,000.00$$

  Kyle needs a down payment of \$12 000.00.

- Find the amount of the mortgage that Kyle will need.

  Solution:

  The mortgage amount will be
  $\$120\,000.00 - \$12\,000.00 = \$108\,000.00$.

  Kyle needs a \$108 000.00 mortgage.

- Find Kyle's monthly payment.

  Solution:

  Kyle's monthly payment will be (from the mortgage tables in **Appendix B**) $\$10.25 \times 108 = \$1107.00$.

If you know your monthly mortgage payment, you should be able to calculate the following:

- the total amount that you will repay
- the total interest charges on the life of the mortgage

Go to the next example to see how this is done.

Example 3

Tiffany Muirhead obtained a mortgage of $80 000.00 at 13%/a for thirty years. Tiffany makes monthly payments.

- Find the amount of each monthly payment.

  Solution:
  From the tables in **Appendix B** $\$10.97 \times 80 = \$877.60$.
  The monthly payments are $877.60.

- Find the total amount that will be paid.

  Solution:
  The total amount is $\$887.60 \times 12 \times 30 = \$315\ 936.00$.
  The total amount paid out is $315 936.00.

- Find the total amount of interest charged over the life of the mortgage.

  Solution:
  Interest charged $= \$315\ 936.00 - \$80\ 000.00$
  $= \$235\ 936.00$
  The total amount of interest is $235 936.00.

The next example illustrates how you may save money by reducing the amortization period.

Example 4

Danielle and Jarrett Hudson just received approval on a \$90 000.00 mortgage at $13\frac{1}{2}$%/a. How much interest would this couple save if they decided to pay their mortgage in twenty years rather than twenty-five years?

Solution:

	Twenty years	Twenty-five years
Monthly payment	$\$11.82 \times 90 = \$1063.80$	$\$11.36 \times 90 = \$1022.40$
Total amount paid	$\$1063.80 \times 12 \times 20 = \$255\ 312.00$	$\$1022.40 \times 12 \times 25 = \$306\ 720.00$
Amount of interest paid	$\$255\ 312.00 - \$90\ 000.00 = \$165\ 312.00$	$\$306\ 720.00 - \$90\ 000.00 = \$216\ 720.00$

If the Hudsons elected to pay their mortgage in twenty years instead of twenty-five years, they would save $\$216\ 720.00 - \$165\ 312.00 = \$51\ 408.00$.

Do the following exercises.

1. What is a mortgage?

2. How does the amortization period of a mortgage differ from the term of a mortgage?

3. Why do most people prefer blended mortgage payments?

4. Using the mortgage tables in **Appendix B**, find the monthly payment needed to repay the mortgages outlined as follows. Do any three.

   a. \$50 000 at $12\frac{3}{4}$%/a for fifteen years

   b. \$175 000 at 11%/a for twenty years

   c. \$96 500 at $14\frac{1}{2}$%/a for twenty-five years

   d. \$92 785 at $15\frac{1}{4}$%/a for thirty years

   e. \$54 300 at $9\frac{3}{4}$%/a for thirty-five years

5. A piece of lakefront property is priced to sell at \$96 000. What is the maximum amount of money that a bank will give you for a mortgage on this property if the required down payment is 10% of the selling price?

6. For each mortgage which follows, find the total amount of interest that is paid over the life of the mortgage.

   a. \$96 000.00 at $12\frac{1}{4}$%/a for fifteen years

   b. \$83 500.00 at $11\frac{3}{4}$%/a for thirty years

   c. \$132 000.00 at 14%/a for twenty-five years

7. How much money would you save amortizing a \$93 000.00 mortgage at $12\frac{1}{2}$%/a over twenty years rather than thirty years?

For solutions to **Activity 1**, turn to **Appendix A, Topic 2**.

If you require help, do the Extra Help section.

If you want more challenging explorations, do the Extensions section.

} You may decide to do both.

Extra Help

If you have trouble determining monthly mortgage payments from a table, then this section could be helpful to you. Many banks have Monthly Mortgage Payment Calculators that you can obtain free of charge. With this mortgage payment calculator, you can easily determine the monthly mortgage payments provided that the term of the mortgage and the interest rate are known. If your bank does not have one of these calculators available, you can make your own. See **Appendix B** for instructions on how to make your own calculator. To use this calculator, match the annual interest rate (the number in the small window) with the amortization period which is displayed above the large window. The reading that you see in the large window represents the monthly payment needed for a $1000 mortgage.

Use this Monthly Mortgage Payment Calculator to find the monthly payment on each mortgage which follows.

1. $120 000 mortgage at $13\frac{3}{4}$%/a for twenty-five years

2. $80 000 mortgage at $12\frac{1}{2}$%/a for twenty years

3. $50 000 mortgage at 11%/a for fifteen years

For solutions to **Extra Help**, turn to **Appendix A, Topic 2**.

Extensions

If you are interested in finding out how the values in mortgage tables are calculated, then you will find this section informative. Banks and lending institutions use computers to calculate monthly mortgage payments. There is a formula that you may use to find these values. The following formula may be used to find the blended monthly payment on a mortgage if interest is calculated semiannually. You will need your calculator to work with this formula.

$$R = P\left[\frac{1-(1+0.5i)^{-2n}}{0.5i}\right]^{-1}\left[\frac{\left(1+\frac{i}{12}\right)^{6}-1}{\frac{i}{12}}\right]^{-1}$$

R = amount of monthly payment

P = principal of the mortgage

i = annual interest rate

n = amortization period

Look at the following example to see how this formula can be used.

Example 5

Mr. and Mrs. Lafey obtained a $90 000 mortgage at 15%/a for twenty years. Calculate the monthly mortgage payment using the formula and check your answer using mortgage tables.

Solution:

$$R = P\left[\frac{1-(1+0.5i)^{-2n}}{0.5i}\right]^{-1}\left[\frac{\left(1+\frac{i}{12}\right)^{6}-1}{\frac{i}{12}}\right]^{-1}$$

$R = ?,\ P = \$90\ 000,\ i = 15\% = 0.15,\ n = 20$ years

$$R = 90\ 000\left[\frac{1-(1+0.5\times 0.15)^{-2\times 20}}{0.5\times 0.15}\right]^{-1}\left[\frac{\left(1+\frac{0.15}{12}\right)^{6}-1}{\frac{0.15}{12}}\right]^{-1}$$

$$R = 90\ 000\left[\frac{1-(1.075)^{-40}}{0.075}\right]^{-1}\left[\frac{(1.0125)^{6}-1}{0.0125}\right]^{-1}$$

$$R = 90\ 000(0.079\ 400\ 313)(0.161\ 533\ 81)$$

$$R = \$1154.33$$

The monthly payment is $1154.33.

Using the table, the monthly payments would be $\$12.84 \times 90 = \$1155.60$.

Differences between the amount calculated using the formula and the tables are due to rounding off which takes place when using the formula to get the approximate values 0.079 400 313 and 0.161 533 81.

Now try the following questions.

Using the formula, find the monthly payment on each mortgage which follows and check your answer by using the tables.

1. $100 000 mortgage at 10%/a over twenty-five years

2. $50 000 mortgage at 12%/a over twenty years

For solutions to **Extensions**, turn to **Appendix A, Topic 2**.

Unit Summary

What You Have Learned

In this unit you have learned the following:

- The amount of interest charged on a loan depends upon several things:
  - the principal of the loan
  - the interest rate in effect
  - the time within which the loan is to be repaid
  - the frequency of payments
- To calculate the interest paid on a lump-sum payment, you use the formula $I = Prt$.
- The period of repayment of a loan determines the amount of the monthly payment and the total interest paid on the loan.
- Loans may be repaid using nonblended payments or blended payments.
- Amortization tables show the breakdown of each monthly payment.
- Lending institutions use tables to determine monthly loan and mortgage payments.
- Monthly loan and mortgage payments can be calculated using tables.
- A mortgage is a special kind of loan, and all mortgages require property as collateral.

You are now ready to

complete the **Unit Assignment**.

Appendices

Appendix A
Solutions

Review

Topic 1 Loans

Topic 2 Mortgages

Appendix B
Tables

Loan Tables

Monthly Loan Payment Calculator

Mortgage Tables

Monthly Mortgage Payment Calculator

Appendix A
Solutions

Review

1. a. $I = Prt$ $\quad I = ?,\ P = \$500.00,\ t = 3,$

$$r = 12\% = \frac{12}{100} = 0.12$$

$$I = (\$500.00)(0.12)(3)$$
$$= \$180.00$$

b. $I = Prt$ $\quad I = ?,\ P = \$850.00,\ t = \frac{11}{12},$

$$r = 13\tfrac{1}{2}\% = \frac{13\frac{1}{2}}{100} = 0.135$$

$$I = (\$850.00)(0.135)\left(\frac{11}{12}\right)$$
$$= \$105.19$$

c. $I = Prt$ $\quad I = ?,\ P = \$1150.00,\ t = \frac{68}{365},$

$$r = 12\tfrac{3}{4}\% = \frac{12\frac{3}{4}}{100} = 0.1275$$

$$I = (\$1150.00)(0.1275)\left(\frac{68}{365}\right)$$
$$= \$27.32$$

2. a. $(350)(0.083)\left(\frac{2}{3}\right) = 19.3\dot{6}$

b. $(780)(0.123)\left(\frac{43}{75}\right) = 55.0056$

c. $\left(\frac{3}{17}\right)(1.732)(156.50) = 47.8337647$

If you had trouble with these questions, refer back to **Unit 7, Annuities.**

Exploring Topic 1

Activity 1

Calculate loan payments.

1. Lending institutions charge interest for the use of their money.

2. The four factors are as follows:

   - the amount of money borrowed (principal)
   - the interest rate charged
   - the length of time for repayment
   - the frequency of payments made

3. a. $I = Prt$

   $I = (\$800.00)(0.1425)(1)$

   $= \$114.00$

   The lump-sum payment is $\$800.00 + \$114.00 = \$914.00$.

   b. $I = Prt$

   $I = (\$650.00)(0.1375)\left(\frac{5}{12}\right)$

   $= \$37.24$

   The lump-sum payment is $\$650.00 + \$37.24 = \$687.24$.

   c. $I = Prt$

   $I = (\$1250.00)(0.1172)\left(\frac{68}{365}\right)$

   $= \$27.29$

   The lump-sum payment is $\$1250.00 + \$27.29 = \$1277.29$.

   d. $I = Prt$

   $I = (\$2200.00)(0.11)\left(\frac{9}{12}\right)$

   $= \$181.50$

   The lump-sum payment is $\$2200.00 + \$181.50 = \$2381.50$.

   e. $I = Prt$

   $I = (\$975.00)(0.1235)\left(\frac{115}{365}\right)$

   $= \$37.94$

   The lump-sum payment is $\$975.00 + \$37.94 = \$1012.94$.

4. If the term of the loan is short, the monthly payments will be larger and the total amount of interest payable will be smaller. If the term is long, the monthly payments will be smaller and the total amount of interest paid would be larger.

5. Due to your low-paying job, your monthly payments would probably need to be small. This would require repayment of the loan over a long period of time.

6. The amount paid on the principal is constant for nonblended payments. Therefore, the answer is A.

7. a.

Payment Number	Balance Owing	Amount Paid on Principal	Amount of Interest Paid	Total Payment	Outstanding Balance
1	\$2100.00	\$2100.00 ÷ 3 = \$700.00	$I = (\$2100.00)(0.18)\left(\frac{1}{12}\right)$ $I = \$31.50$	\$700.00 + \$31.50 = \$731.50	\$2100.00 – \$700.00 = \$1400.00
2	\$1400.00	\$700.00	$I = (\$1400.00)(0.18)\left(\frac{1}{12}\right)$ $I = \$21.00$	\$700.00 + \$21.00 = \$721.00	\$1400.00 – \$700.00 = \$700.00
3	\$700.00	\$700.00	$I = (\$700.00)(0.18)\left(\frac{1}{12}\right)$ $I = \$10.50$	\$700.00 + \$10.50 = \$710.50	\$700.00 – \$700.00 = 0

b.

Payment Number	Balance Owing	Amount Paid on Principal	Amount of Interest Paid	Total Payment	Outstanding Balance
1	\$3300.00	\$3300.00 ÷ 3 = \$1100.00	$I = (\$3300.00)(0.15)\left(\frac{1}{12}\right)$ = \$41.25	\$1100.00 + \$41.25 = \$1141.25	\$3300.00 – \$1100.00 = \$2200.00
2	\$2200.00	\$1100.00	$I = (\$2200.00)(0.15)\left(\frac{1}{12}\right)$ = \$27.50	\$1100.00 + \$27.50 = \$1127.50	\$2200.00 – \$1100.00 = \$1100.00
3	\$1100.00	\$1100.00	$I = (\$1100.00)(0.15)\left(\frac{1}{12}\right)$ = \$13.75	\$1100.00 + \$13.75 = \$1113.75	\$1100.00 – \$1100.00 = 0

8. The total amount paid per month is constant for blended payments. Therefore, the answer is C.

9. a.

Payment Number	Balance Owing	Amount of Interest Paid	Amount Paid on Principal	Total Payment	Outstanding Balance
1	\$30 000.00	$I = (\$30\ 000.00)(0.12)\left(\frac{1}{12}\right)$ = \$300.00	\$330.30 – \$300.00 = \$30.30	\$330.30	\$30 000.00 – \$30.30 = \$29 969.70
2	\$29 969.70	$I = (\$29\ 969.70)(0.12)\left(\frac{1}{12}\right)$ = \$299.70	\$330.30 – \$299.70 = \$30.60	\$330.30	\$29 969.70 – \$30.60 = \$29 939.10
3	\$29 939.10	$I = (\$29\ 939.10)(0.12)\left(\frac{1}{12}\right)$ = \$299.39	\$330.30 – \$299.39 = \$30.91	\$330.30	\$29 939.10 – \$30.91 = \$29 908.19

b.

Payment Number	Balance Owing	Amount of Interest Paid	Amount Paid on Principal	Total Payment	Outstanding Balance
1	\$25 000.00	$I = (\$25\ 000.00)(0.18)\left(\frac{1}{12}\right)$ = \$375.00	\$450.50 – \$375.00 = \$75.50	\$450.50	\$25 000.00 – \$75.50 = \$24 924.50
2	\$24 924.50	$I = (\$24\ 924.50)(0.18)\left(\frac{1}{12}\right)$ = \$373.87	\$450.50 – \$373.87 = \$76.63	\$450.50	\$24 924.50 – \$76.63 = \$24 847.87
3	\$24 847.87	$I = (\$24\ 847.87)(0.18)\left(\frac{1}{12}\right)$ = \$372.72	\$450.50 – \$372.72 = \$77.78	\$450.50	\$24 847.87 – \$77.78 = \$24 770.09

10. a. $\$38.103 \times 15 = \$571.55$ per month

b. $\$22.625 \times 27 = \$610.88$ per month

c. $\$25.267 \times 15.7 = \$396.69$ per month

d. $\$33.214 \times 17.5 = \$581.25$ per month

e. $\$25.603 \times 36.3 = \$929.39$ per month

11. a. • The monthly payment is $\$28.914 \times 22 = \$636.11$.

• The total amount repaid is $\$636.11 \times 42 = \$26\ 716.62$.

• The interest charge is $\$26\ 716.62 - \$22\ 000.00 = \$4716.62$.

b. • The monthly payment is $\$22.498 \times 18 = \$404.96$.

• The total amount repaid is $\$404.96 \times 60 = \$24\ 297.60$.

• The interest charge is $\$24\ 297.60 - \$18\ 000.00 = \$6297.60$.

c. • The monthly payment is $\$17.653 \times 32 = \$564.90$.

• The total amount repaid is $\$564.90 \times 84 = \$47\ 451.60$.

• The interest charge is $\$47\ 451.60 - \$32\ 000.00 = \$15\ 451.60$.

Extra Help

1. $\$14.64 \times 5 = \$73.20$ per month

2. $\$10.32 \times 15 = \$154.80$ per month

3. $\$22.24 \times 23 = \$511.52$ per month

Extensions

1. $$R = \frac{Pi}{1-(1+i)^{-n}}$$

$$R = \frac{(17\,000)(0.01)}{1-(1+0.01)^{-60}}$$

$$= \frac{170}{0.449\,550\,384}$$

$$= \$378.16$$

$R = ?$

$P = \$17\,000$

$i = 12\% \div 12$

$= 1\%$ per month

$n = 12 \times 5$

$= 60$ payments

The monthly payment is $378.16. Checking with the value from the table shows that the monthly payment is $378.15. The difference between the two values is very small, showing that either method can be used to calculate the amount of the payment.

2. $R = \dfrac{Pi}{1-(1+i)^{-n}}$

$= \dfrac{(25\,000)(0.008\,333)}{1-(1+0.008\,333)^{-84}}$

$= \dfrac{208.325}{0.501\,958\,398}$

$= \$415.02$

$R = ?$

$P = \$25\,000$

$i = 10\% \div 12$

$= 0.8333\%$ (rounded)

$= 0.008\,333$ (rounded)

$n = 12 \times 7$

$= 84$ payments

The monthly payment is \$415.02. The value from the table is \$415.03. These two values are almost the same.

Exploring Topic 2

Activity 1

Calculate mortgage payments.

1. A mortgage is a long-term loan using property as collateral or security.

2. The amortization period refers to the total time within which the mortgage must be repaid. The term of a mortgage refers to a shorter period of time within which a specified interest rate is in effect.

3. Blended mortgage payments are identical in amount every month. Borrowers prefer this because it is easier to budget for the constant payments.

4. a. $\$12.28 \times 50 = \$614.00$ per month

   b. $\$10.16 \times 175 = \$1778.00$ per month

   c. $\$12.10 \times 96.5 = \$1167.65$ per month

   d. $\$12.48 \times 92.785 = \$1157.96$ per month (rounded to the nearest cent)

   e. $\$8.26 \times 54.3 = \$448.52$ per month (rounded to the nearest cent)

5. The down payment required is 10% of \$96 000.

   10% of \$96 000 $= 0.10 \times \$96\,000$

   $= \$9600$

   The maximum mortgage amount is $\$96\,000 - \$9600 = \$86\,400$.

6. a. The monthly payment is $\$11.97 \times 96 = \$1149.12$.

   The total amount paid is $\$1149.12 \times 12 \times 15 = \$206\,841.60$.

   The total interest paid is
   $\$206\,841.60 - \$96\,000.00 = \$110\,841.60$.

b. The monthly payment is $\$9.88 \times 83.5 = \$824.98$.

The total amount paid is $\$824.98 \times 12 \times 30 = \$296\ 992.80$.

The total interest paid is $\$296\ 992.80 - \$83\ 500.00 = \$213\ 492.80$.

c. The monthly payment is $\$11.74 \times 132 = \$1549.68$.

The total amount paid is $\$1549.68 \times 12 \times 25 = \$464\ 904.00$.

The total interest paid is $\$464\ 904.00 - \$132\ 000.00 = \$332\ 904.00$.

7.

Entry	Twenty years	Thirty years
Monthly payment	$\$11.15 \times 93 = \$1036.95$	$\$10.43 \times 93 = \$969.99$
Total of all payments	$\$1036.95 \times 12 \times 20 = \$248\ 868.00$	$\$969.99 \times 12 \times 30 = \$349\ 196.40$
Total interest paid	$\$248\ 868.00 - \$93\ 000.00 = \$155\ 868.00$	$\$349\ 196.40 - \$93\ 000.00 = \$256\ 196.40$

To amortize your mortgage in twenty years instead of thirty years, you would save $\$256\ 196.40 - \$155\ 868.00 = \$100\ 328.40$.

Extra Help

1. $\$11.56 \times 120 = \$1387.20$ per month
2. $\$11.15 \times 80 = \$892.00$ per month
3. $\$11.21 \times 50 = \$560.50$ per month

Extensions

1. $$R = P\left[\frac{1-(1+0.5i)^{-2n}}{0.5i}\right]^{-1}\left[\frac{\left(1+\frac{i}{12}\right)^{6}-1}{\frac{i}{12}}\right]^{-1},$$

where $P = \$100\ 000$, $i = 10\% = 0.10$, $n =$ twenty-five years

$$R = 100\ 000\left\{\frac{1-[1+(0.5)(0.10)]^{-2(25)}}{(0.5)(0.10)}\right\}^{-1}\left[\frac{\left(1+\frac{0.10}{12}\right)^{6}-1}{\frac{0.10}{12}}\right]^{-1}$$

$$R = 100\ 000\left[\frac{1-(1+0.05)^{-50}}{0.05}\right]^{-1}\left[\frac{\left(1+0.008\dot{3}\right)^{6}-1}{0.008\dot{3}}\right]^{-1}$$

$R = 100\ 000(0.054\ 776\ 735)(0.163\ 228\ 061)$

$R = \$894.11$

The monthly payment is \$894.11. Using the table, you would get \$894.00. Both methods result in an almost identical amount which means that either method can be used because of its reliability.

2. $$R = P\left[\frac{1-(1+0.5i)^{-2n}}{0.5i}\right]^{-1}\left[\frac{\left(1+\frac{i}{12}\right)^{6}-1}{\frac{i}{12}}\right]^{-1},$$

where $P = \$50\ 000$, $i = 12\% = 0.12$, $n =$ twenty years

$$R = 50\ 000\left\{\frac{1-[1+(0.5)(0.12)]^{-2(20)}}{(0.5)(0.12)}\right\}^{-1}\left[\frac{\left(1+\frac{0.12}{12}\right)^{6}-1}{0.01}\right]^{-1}$$

$$R = 50\ 000\left[\frac{1-(1+0.06)^{-40}}{0.06}\right]^{-1}\left[\frac{(1+0.01)^{6}-1}{0.01}\right]^{-1}$$

$R = 50\ 000(0.066\ 461\ 535)(0.162\ 548\ 367)$

$R = \$540.16$

The monthly payment is \$540.16. Using the table, you would get \$540.50. Both methods result in an almost identical amount which means that either method can be used because of its reliability.

Appendix B
Tables

Monthly Payment on a $1000 Loan at 10% to 11$\frac{3}{8}$% (includes principal and interest)

Interest Rates	10%	10$\frac{1}{8}$%	10$\frac{1}{4}$%	10$\frac{3}{8}$%	10$\frac{1}{2}$%	10$\frac{5}{8}$%	10$\frac{3}{4}$%	10$\frac{7}{8}$%	11%	11$\frac{1}{8}$%	11$\frac{1}{4}$%	11$\frac{3}{8}$%
Terms in Months												
1	1008.333	1008.437	1008.542	1008.646	1008.750	1008.854	1008.958	1009.062	1009.167	1009.271	1009.375	1009.479
2	506.259	506.337	506.415	506.494	506.572	506.650	506.729	506.807	506.885	506.964	507.042	507.121
3	338.904	338.974	339.044	339.114	339.184	339.253	339.323	339.393	339.463	339.533	339.603	339.673
4	255.230	255.296	255.361	255.427	255.493	255.558	255.624	255.690	255.755	255.821	255.887	255.952
5	205.028	205.091	205.154	205.217	205.280	205.344	205.407	205.470	205.533	205.597	205.660	205.723
6	171.561	171.623	171.685	171.746	171.808	171.870	171.931	171.993	172.055	172.116	172.178	172.240
7	147.659	147.719	147.780	147.840	147.901	147.961	148.022	148.082	148.143	148.204	148.264	148.325
8	129.733	129.793	129.852	129.912	129.972	130.032	130.091	130.151	130.211	130.271	130.331	130.391
9	115.792	115.851	115.910	115.969	116.029	116.088	116.147	116.206	116.266	116.325	116.384	116.444
10	104.640	104.699	104.758	104.817	104.875	104.934	104.993	105.052	105.111	105.170	105.228	105.287
11	95.517	95.576	95.634	95.693	95.751	95.810	95.868	95.927	95.985	96.044	96.102	96.161
12	87.916	87.974	88.032	88.090	88.149	88.207	88.265	88.323	88.382	88.440	88.498	88.557
13	81.485	81.543	81.601	81.659	81.717	81.775	81.833	81.891	81.949	82.007	82.065	82.124
14	75.973	76.031	76.089	76.147	76.205	76.262	76.320	76.378	76.436	76.494	76.552	76.610
15	71.197	71.255	71.313	71.370	71.428	71.486	71.544	71.602	71.660	71.718	71.775	71.833
16	67.019	67.077	67.134	67.192	67.250	67.307	67.365	67.423	67.481	67.539	67.597	67.655
17	63.333	63.390	63.448	63.506	63.563	63.621	63.679	63.737	63.795	63.852	63.910	63.968
18	60.057	60.115	60.172	60.230	60.288	60.345	60.403	60.461	60.519	60.576	60.634	60.692
19	57.127	57.184	57.242	57.299	57.357	57.415	57.473	57.530	57.588	57.646	57.704	57.762
20	54.490	54.547	54.605	54.663	54.720	54.778	54.836	54.894	54.951	55.009	55.067	55.125
21	52.105	52.162	52.220	52.278	52.335	52.393	52.451	52.509	52.567	52.624	52.682	52.740
22	49.937	49.995	50.052	50.110	50.168	50.226	50.283	50.341	50.399	50.457	50.515	50.573
23	47.958	48.016	48.074	48.131	48.189	48.247	48.305	48.363	48.421	48.479	48.537	48.595
24	46.145	46.203	46.260	46.318	46.376	46.434	46.492	46.550	46.608	46.666	46.724	46.782
25	44.477	44.535	44.593	44.651	44.708	44.766	44.824	44.882	44.940	44.999	45.057	45.115
26	42.938	42.996	43.054	43.112	43.170	43.228	43.286	43.344	43.402	43.460	43.518	43.577
27	41.513	41.571	41.629	41.687	41.745	41.803	41.861	41.920	41.978	42.036	42.095	42.153
28	40.191	40.249	40.307	40.365	40.423	40.481	40.539	40.598	40.656	40.714	40.773	40.831
29	38.960	39.018	39.076	39.134	39.192	39.251	39.309	39.367	39.426	39.484	39.543	39.601
30	37.811	37.870	37.928	37.986	38.044	38.103	38.161	38.220	38.278	38.337	38.395	38.454
31	36.737	36.796	36.854	36.912	36.971	37.029	37.088	37.146	37.205	37.263	37.322	37.381
32	35.731	35.789	35.848	35.906	35.965	36.023	36.082	36.140	36.199	36.258	36.317	36.376
33	34.786	34.844	34.903	34.961	35.020	35.078	35.137	35.196	35.255	35.314	35.373	35.432
34	33.896	33.955	34.014	34.072	34.131	34.190	34.248	34.307	34.366	34.425	34.484	34.543
35	33.058	33.117	33.176	33.234	33.293	33.352	33.411	33.470	33.529	33.588	33.647	33.707
36	32.267	32.326	32.385	32.444	32.502	32.561	32.620	32.680	32.739	32.798	32.857	32.917
37	31.519	31.578	31.637	31.696	31.755	31.814	31.873	31.932	31.991	32.051	32.110	32.170
38	30.811	30.870	30.929	30.988	31.047	31.106	31.165	31.225	31.284	31.343	31.403	31.462
39	30.139	30.198	30.257	30.316	30.375	30.435	30.494	30.553	30.613	30.673	30.732	30.792
40	29.501	29.560	29.619	29.678	29.738	29.797	29.857	29.916	29.976	30.036	30.095	30.155

Monthly Payment on a $1000 Loan at 10% to $11\frac{3}{8}$% (includes principal and interest) continued

Interest Rates	10%	$10\frac{1}{8}$%	$10\frac{1}{4}$%	$10\frac{3}{8}$%	$10\frac{1}{2}$%	$10\frac{5}{8}$%	$10\frac{3}{4}$%	$10\frac{7}{8}$%	11%	$11\frac{1}{8}$%	$11\frac{1}{4}$%	$11\frac{3}{8}$%
Terms in Months												
41	28.894	28.953	29.013	29.072	29.132	29.191	29.251	29.311	29.370	29.430	29.490	29.550
42	28.317	28.376	28.436	28.495	28.555	28.614	28.674	28.734	28.794	28.854	28.914	28.974
43	27.767	27.826	27.886	27.945	28.005	28.065	28.125	28.185	28.245	28.305	28.365	28.425
44	27.242	27.301	27.361	27.421	27.480	27.540	27.600	27.660	27.720	27.781	27.841	27.901
45	26.740	26.800	26.860	26.919	26.979	27.039	27.100	27.160	27.220	27.280	27.341	27.401
46	26.261	26.321	26.380	26.440	26.501	26.561	26.621	26.681	26.742	26.802	26.863	26.923
47	25.802	25.862	25.922	25.982	26.042	26.103	26.163	26.223	26.284	26.345	26.405	26.466
48	25.363	25.423	25.483	25.543	25.603	25.664	25.724	25.785	25.846	25.906	25.967	26.028
49	24.941	25.002	25.062	25.122	25.183	25.243	25.304	25.365	25.425	25.486	25.547	25.608
50	24.537	24.598	24.658	24.718	24.779	24.840	24.900	24.961	25.022	25.083	25.144	25.205
51	24.149	24.210	24.270	24.331	24.391	24.452	24.513	24.574	24.635	24.696	24.758	24.819
52	23.776	23.837	23.897	23.958	24.019	24.080	24.141	24.202	24.263	24.325	24.386	24.447
53	23.418	23.478	23.539	23.600	23.661	23.722	23.783	23.844	23.906	23.967	24.029	24.090
54	23.072	23.133	23.194	23.255	23.316	23.377	23.439	23.500	23.561	23.623	23.685	23.746
55	22.740	22.801	22.862	22.923	22.984	23.046	23.107	23.169	23.230	23.292	23.354	23.416
56	22.420	22.481	22.542	22.603	22.664	22.726	22.787	22.849	22.911	22.973	23.035	23.097
57	22.111	22.172	22.233	22.295	22.356	22.418	22.479	22.541	22.603	22.665	22.727	22.789
58	21.813	21.874	21.935	21.997	22.059	22.120	22.182	22.244	22.306	22.368	22.430	22.493
59	21.525	21.586	21.648	21.710	21.771	21.833	21.895	21.957	22.019	22.082	22.144	22.206
60	21.247	21.309	21.370	21.432	21.494	21.556	21.618	21.680	21.742	21.805	21.867	21.930
61	20.978	21.040	21.102	21.164	21.226	21.288	21.350	21.412	21.475	21.537	21.600	21.663
62	20.719	20.780	20.842	20.904	20.966	21.029	21.091	21.153	21.216	21.279	21.342	21.404
63	20.467	20.529	20.591	20.653	20.716	20.778	20.840	20.903	20.966	21.029	21.091	21.154
64	20.224	20.286	20.348	20.410	20.473	20.535	20.598	20.661	20.723	20.786	20.849	20.913
65	19.998	20.050	20.113	20.175	20.238	20.300	20.363	20.426	20.489	20.552	20.615	20.678
66	19.760	19.822	19.884	19.947	20.010	20.072	20.135	20.198	20.261	20.325	20.388	20.452
67	19.538	19.601	19.663	19.726	19.789	19.852	19.915	19.978	20.041	20.105	20.168	20.232
68	19.324	19.386	19.449	19.512	19.575	19.638	19.701	19.764	19.827	19.891	19.955	20.018
69	19.115	19.178	19.241	19.304	19.367	19.430	19.493	19.557	19.620	19.684	19.748	19.812
70	18.913	18.976	19.039	19.102	19.165	19.228	19.292	19.355	19.419	19.483	19.547	19.611
71	18.717	18.780	18.843	18.906	18.969	19.033	19.096	19.160	19.224	19.288	19.352	19.416
72	18.526	18.589	18.652	18.716	18.779	18.843	18.906	18.970	19.034	19.098	19.162	19.227
73	18.340	18.404	18.467	18.531	18.594	18.658	18.722	18.786	18.850	18.914	18.978	19.043
74	18.160	18.224	18.287	18.351	18.414	18.478	18.542	18.606	18.671	18.735	18.799	18.864
75	17.985	18.048	18.112	18.176	18.240	18.304	18.368	18.432	18.496	18.561	18.626	18.690
76	17.814	17.878	17.942	18.006	18.070	18.134	18.198	18.262	18.327	18.392	18.456	18.521
77	17.648	17.712	17.776	17.840	17.904	17.969	18.033	18.097	18.162	18.227	18.292	18.357
78	17.487	17.551	17.615	17.679	17.743	17.808	17.872	17.937	18.002	18.067	18.132	18.197
79	17.330	17.394	17.458	17.522	17.586	17.651	17.716	17.780	17.845	17.911	17.976	18.041
80	17.176	17.241	17.305	17.369	17.434	17.498	17.563	17.628	17.693	17.759	17.824	17.889
81	17.027	17.091	17.156	17.220	17.285	17.350	17.415	17.480	17.545	17.610	17.676	17.742
82	16.881	16.946	17.010	17.075	17.140	17.205	17.270	17.335	17.401	17.466	17.532	17.598
83	16.740	16.804	16.869	16.934	16.999	17.064	17.129	17.194	17.260	17.325	17.391	17.457
84	16.601	16.666	16.731	16.796	16.861	16.926	16.991	17.057	17.122	17.188	17.254	17.320
85	16.466	16.531	16.596	16.661	16.726	16.792	16.857	16.923	16.989	17.054	17.121	17.187
86	16.334	16.399	16.464	16.530	16.595	16.660	16.726	16.792	16.858	16.924	16.990	17.057
87	16.206	16.271	16.336	16.401	16.467	16.533	16.598	16.664	16.730	16.797	16.863	16.929
88	16.080	16.145	16.211	16.276	16.342	16.408	16.474	16.540	16.606	16.672	16.739	16.805

Monthly Payment on a $1000 Loan at $11\frac{1}{2}\%$ to $12\frac{7}{8}\%$ (includes principal and interest)

Interest Rates	$11\frac{1}{2}\%$	$11\frac{5}{8}\%$	$11\frac{3}{4}\%$	$11\frac{7}{8}\%$	12%	$12\frac{1}{8}\%$	$12\frac{1}{4}\%$	$12\frac{3}{8}\%$	$12\frac{1}{2}\%$	$12\frac{5}{8}\%$	$12\frac{3}{4}\%$	$12\frac{7}{8}\%$
Terms in Months												
1	1009.583	1009.687	1009.792	1009.896	1010.000	1010.104	1010.208	1010.312	1010.417	1010.521	1010.625	1010.729
2	507.199	507.277	507.356	507.434	507.512	507.591	507.669	507.748	507.826	507.904	507.983	508.061
3	339.743	339.812	339.882	339.952	340.022	340.092	340.162	340.232	340.302	340.372	340.442	340.512
4	256.018	256.084	256.150	256.215	256.281	256.347	256.413	256.478	256.544	256.610	256.676	256.742
5	205.787	205.850	205.913	205.976	206.040	206.103	206.166	206.230	206.293	206.357	206.420	206.483
6	172.301	172.363	172.425	172.487	172.548	172.610	172.672	172.734	172.796	172.857	172.919	172.981
7	148.386	148.446	148.507	148.568	148.628	148.689	148.750	148.810	148.871	148.932	148.993	149.054
8	130.451	130.511	130.570	130.630	130.690	130.750	130.810	130.870	130.930	130.990	131.050	131.110
9	116.503	116.562	116.622	116.681	116.740	116.800	116.859	116.919	116.978	117.038	117.097	117.157
10	105.346	105.405	105.464	105.523	105.582	105.641	105.700	105.759	105.818	105.877	105.936	105.995
11	96.219	96.278	96.337	96.395	96.454	96.513	96.572	96.630	96.689	96.748	96.807	96.865
12	88.615	88.673	88.732	88.790	88.849	88.907	88.966	89.024	89.083	89.141	89.200	89.259
13	82.182	82.240	82.298	82.357	82.415	82.473	82.531	82.590	82.648	82.707	82.765	82.824
14	76.669	76.727	76.785	76.843	76.901	76.959	77.018	77.076	77.134	77.192	77.251	77.309
15	71.891	71.950	72.008	72.066	72.124	72.182	72.240	72.298	72.357	72.415	72.473	72.531
16	67.712	67.770	67.828	67.887	67.945	68.003	68.061	68.119	68.177	68.235	68.294	68.352
17	64.026	64.084	64.142	64.200	64.258	64.316	64.374	64.432	64.491	64.549	64.607	64.665
18	60.750	60.808	60.866	60.924	60.982	61.040	61.098	61.156	61.215	61.273	61.331	61.389
19	57.820	57.878	57.936	57.994	58.052	58.110	58.168	58.226	58.284	58.343	58.401	58.459
20	55.183	55.241	55.299	55.357	55.415	55.473	55.532	55.590	55.648	55.706	55.765	55.823
21	52.798	52.856	52.914	52.973	53.031	53.089	53.147	53.205	53.264	53.322	53.380	53.439
22	50.631	50.689	50.747	50.806	50.864	50.922	50.980	51.039	51.097	51.155	51.214	51.272
23	48.653	48.711	48.769	48.828	48.886	48.944	49.003	49.061	49.119	49.178	49.236	49.295
24	46.840	46.899	46.957	47.015	47.073	47.132	47.190	47.249	47.307	47.366	47.424	47.483
25	45.173	45.232	45.290	45.348	45.407	45.465	45.524	45.582	45.641	45.700	45.758	45.817
26	43.635	43.693	43.752	43.810	43.869	43.927	43.986	44.045	44.103	44.162	44.221	44.280
27	42.211	42.270	42.328	42.387	42.446	42.504	42.563	42.622	42.680	42.739	42.798	42.857
28	40.890	40.948	41.007	41.066	41.124	41.183	41.242	41.301	41.360	41.419	41.478	41.537
29	39.660	39.719	39.777	39.836	39.895	39.954	40.013	40.072	40.131	40.190	40.249	40.308
30	38.513	38.571	38.630	38.689	38.748	38.807	38.866	38.925	38.984	39.044	39.103	39.162
31	37.440	37.499	37.558	37.617	37.676	37.735	37.794	37.853	37.912	37.972	38.031	38.091
32	36.435	36.494	36.553	36.612	36.671	36.730	36.789	36.849	36.908	36.968	37.027	37.087
33	35.491	35.550	35.609	35.668	35.727	35.787	35.846	35.906	35.965	36.025	36.084	36.144
34	34.603	34.662	34.721	34.781	34.840	34.899	34.959	35.019	35.078	35.138	35.198	35.258
35	33.766	33.825	33.885	33.944	34.004	34.063	34.123	34.183	34.242	34.302	34.362	34.422
36	32.976	33.035	33.095	33.155	33.214	33.274	33.334	33.394	33.454	33.514	33.574	33.634
37	32.229	32.289	32.349	32.408	32.468	32.528	32.588	32.648	32.708	32.768	32.828	32.888
38	31.522	31.582	31.642	31.702	31.761	31.821	31.882	31.942	32.002	32.062	32.122	32.183
39	30.852	30.912	30.972	31.032	31.092	31.152	31.212	31.272	31.333	31.393	31.453	31.514
40	30.215	30.275	30.335	30.395	30.456	30.516	30.576	30.637	30.697	30.758	30.818	30.879

Monthly Payment on a $1000 Loan at $11\frac{1}{2}$ % to $12\frac{7}{8}$ % (includes principal and interest) continued

Interest Rates	$11\frac{1}{2}$ %	$11\frac{5}{8}$ %	$11\frac{3}{4}$ %	$11\frac{7}{8}$ %	12%	$12\frac{1}{8}$ %	$12\frac{1}{4}$ %	$12\frac{3}{8}$ %	$12\frac{1}{2}$ %	$12\frac{5}{8}$ %	$12\frac{3}{4}$ %	$12\frac{7}{8}$ %
Terms in Months												
41	29.610	29.670	29.730	29.791	29.851	29.911	29.972	30.032	30.093	30.154	30.215	30.275
42	29.034	29.094	29.155	29.215	29.276	29.336	29.397	29.458	29.518	29.579	29.640	29.701
43	28.485	28.546	28.606	28.667	28.727	28.788	28.849	28.910	28.971	29.032	29.093	29.154
44	27.962	28.022	28.083	28.144	28.204	28.265	28.326	28.387	28.448	28.509	28.571	28.632
45	27.462	27.523	27.583	27.644	27.705	27.766	27.827	27.888	27.949	28.011	28.072	28.134
46	26.984	27.045	27.106	27.167	27.228	27.289	27.350	27.411	27.473	27.534	27.596	27.657
47	26.527	26.588	26.649	26.710	26.771	26.832	26.894	26.955	27.017	27.078	27.140	27.202
48	26.089	26.150	26.211	26.273	26.334	26.395	26.457	26.518	26.580	26.642	26.704	26.765
49	25.669	25.731	25.792	25.853	25.915	25.976	26.038	26.100	26.162	26.223	26.285	26.347
50	25.267	25.328	25.390	25.451	25.513	25.574	25.636	25.698	25.760	25.822	25.884	25.947
51	24.880	24.942	25.003	25.065	25.127	25.189	25.251	25.313	25.375	25.437	25.499	25.562
52	24.509	24.571	24.632	24.694	24.756	24.818	24.880	24.942	25.005	25.067	25.129	25.192
53	24.152	24.214	24.276	24.337	24.400	24.462	24.524	24.586	24.649	24.711	24.774	24.837
54	23.808	23.870	23.932	23.994	24.057	24.119	24.181	24.244	24.306	24.369	24.432	24.495
55	23.477	23.540	23.602	23.664	23.726	23.789	23.851	23.914	23.977	24.040	24.103	24.166
56	23.159	23.221	23.283	23.346	23.408	23.471	23.534	23.596	23.659	23.722	23.785	23.849
57	22.851	22.914	22.976	23.039	23.102	23.164	23.227	23.290	23.353	23.416	23.480	23.543
58	22.555	22.618	22.680	22.743	22.806	22.869	22.932	22.995	23.058	23.121	23.185	23.248
59	22.269	22.332	22.394	22.457	22.520	22.583	22.646	22.710	22.773	22.837	22.900	22.964
60	21.993	22.055	22.118	22.181	22.244	22.308	22.371	22.434	22.498	22.562	22.625	22.689
61	21.726	21.789	21.852	21.915	21.978	22.041	22.105	22.168	22.232	22.296	22.360	22.424
62	21.467	21.530	21.594	21.657	21.720	21.784	21.848	21.911	21.975	22.039	22.103	22.167
63	21.218	21.281	21.344	21.408	21.471	21.535	21.599	21.663	21.727	21.791	21.855	21.919
64	20.976	21.039	21.103	21.166	21.230	21.294	21.358	21.422	21.486	21.550	21.615	21.679
65	20.742	20.805	20.869	20.933	20.997	21.061	21.125	21.189	21.253	21.318	21.382	21.447
66	20.515	20.579	20.643	20.706	20.771	20.835	20.899	20.963	21.028	21.092	21.157	21.222
67	20.295	20.359	20.423	20.487	20.551	20.616	20.680	20.745	20.809	20.874	20.939	21.004
68	20.082	20.146	20.210	20.275	20.339	20.403	20.468	20.533	20.597	20.662	20.727	20.792
69	19.876	19.940	20.004	20.068	20.133	20.197	20.262	20.327	20.392	20.457	20.522	20.587
70	19.675	19.739	19.804	19.868	19.933	19.998	20.062	20.127	20.193	20.258	20.323	20.389
71	19.480	19.545	19.609	19.674	19.739	19.804	19.869	19.934	19.999	20.064	20.130	20.196
72	19.291	19.356	19.420	19.485	19.550	19.615	19.680	19.746	19.811	19.877	19.942	20.008
73	19.107	19.172	19.237	19.302	19.367	19.432	19.498	19.563	19.629	19.694	19.760	19.826
74	18.929	18.994	19.059	19.124	19.189	19.254	19.320	19.386	19.451	19.517	19.583	19.649
75	18.755	18.820	18.885	18.951	19.016	19.082	19.147	19.213	19.279	19.345	19.411	19.477
76	18.586	18.652	18.717	18.782	18.848	18.914	18.979	19.045	19.111	19.178	19.244	19.310
77	18.422	18.487	18.553	18.618	18.684	18.750	18.816	18.882	18.948	19.015	19.081	19.148
78	18.262	18.328	18.393	18.459	18.525	18.591	18.657	18.723	18.790	18.856	18.923	18.990
79	18.107	18.172	18.238	18.304	18.370	18.436	18.502	18.569	18.635	18.702	18.769	18.836
80	17.955	18.021	18.087	18.153	18.219	18.285	18.352	18.418	18.485	18.552	18.619	18.686
81	17.807	17.873	17.939	18.005	18.072	18.138	18.205	18.272	18.338	18.405	18.473	18.540
82	17.663	17.730	17.796	17.862	17.929	17.995	18.062	18.129	18.196	18.263	18.330	18.398
83	17.523	17.589	17.656	17.722	17.789	17.856	17.923	17.990	18.057	18.124	18.192	18.259
84	17.386	17.453	17.519	17.586	17.653	17.720	17.787	17.854	17.921	17.989	18.056	18.124
85	17.253	17.320	17.386	17.453	17.520	17.587	17.654	17.722	17.789	17.857	17.925	17.992
86	17.123	17.190	17.256	17.323								
87	16.996	17.063	17.130	17.197								
88	16.872	16.939	17.006	17.074								

Data Slip

PULL

Monthly Loan Payment on a $1000 Loan

8	86.99	31.34	20.28	12.13	8.36
8 1/4	87.10	31.45	20.40	12.27	8.52
8 1/2	87.22	31.57	20.52	12.40	8.68
8 3/4	87.34	31.68	20.64	12.53	8.84
9	87.45	31.80	20.76	12.67	9.00
9 1/4	87.57	31.92	20.88	12.80	9.16
9 1/2	87.68	32.03	21.00	12.94	9.32
9 3/4	87.80	32.15	21.12	13.08	9.49
10	87.92	32.27	21.25	13.22	9.65
10 1/4	88.03	32.38	21.37	13.35	9.82
10 1/2	88.15	32.50	21.49	13.49	9.98
10 3/4	88.27	32.62	21.62	13.63	10.15
11	88.38	32.74	21.74	13.78	10.32
11 1/4	88.50	32.86	21.87	13.92	10.49
11 1/2	88.62	32.98	21.99	14.06	10.66
11 3/4	88.73	33.10	22.12	14.20	10.84
12	88.85	33.21	22.24	14.35	11.01
12 1/4	88.97	33.33	22.37	14.49	11.19
12 1/2	89.08	33.45	22.50	14.64	11.36
12 3/4	89.20	33.57	22.63	14.78	11.54
13	89.32	33.69	22.75	14.93	11.72
13 1/4	89.44	33.81	22.88	15.08	11.89
13 1/2	89.55	33.94	23.01	15.23	12.07
13 3/4	89.67	34.06	23.14	15.38	12.25
14	89.79	34.18	23.27	15.53	12.44
14 1/4	89.91	34.30	23.40	15.68	12.62
14 1/2	90.02	34.42	23.53	15.83	12.80
14 3/4	90.14	34.54	23.66	15.98	12.98
15	90.26	34.67	23.79	16.13	13.17
15 1/4	90.38	34.79	23.92	16.29	13.35
15 1/2	90.49	34.91	24.05	16.44	13.54
15 3/4	90.61	35.03	24.19	16.60	13.73
16	90.73	35.16	24.32	16.75	13.91
16 1/4	90.85	35.28	24.45	16.91	14.10
16 1/2	90.97	35.40	24.58	17.06	14.29
16 3/4	91.09	35.53	24.72	17.22	14.48
17	91.21	35.65	24.85	17.38	14.67
17 1/4	91.32	35.78	24.99	17.54	14.86
17 1/2	91.44	35.90	25.12	17.70	15.05
17 3/4	91.56	36.03	25.26	17.86	15.24
18	91.68	36.15	25.39	18.02	15.43
18 1/2	91.92	36.40	25.67	18.34	15.82
19	92.16	36.66	25.94	18.67	16.21
19 1/2	92.40	36.91	26.22	19.00	16.60
20	92.63	37.16	26.49	19.33	16.99

PULL

1. Cut along the solid lines and fold along the dotted lines.
2. Glue or tape the left edge of the cutout to the tab on the right side to form a pocket.
3. Insert the data slip into the pocket so that you can see the entries in the two windows.
4. Read the monthly payment from the long window.

Pocket for Data Slip

You may wish to trace this template on stiffer paper. You will then have a longer lasting product.

Monthly Loan Payment Calculator

Interest Rate

%

Repayment Time (in years)

1 3 5 10 20

cut out windows

for a $1000 loan

A.

D.

L.

C.

Just match up the interest rate and the repayment time and the monthly payment will be shown in the window.

Monthly Payment on a $1000 Mortgage
(includes principal and interest)

YEARS	1	2	3	4	5	10	15	20	25	30	35
RATE											
8	86.93	45.17	31.28	24.35	20.21	12.06	9.48	8.28	7.63	7.25	7.01
8 1/4	87.04	45.28	31.39	24.47	20.33	12.19	9.62	8.43	7.79	7.42	7.18
8 1/2	87.15	45.39	31.50	24.58	20.45	12.32	9.76	8.59	7.96	7.59	7.37
8 3/4	87.27	45.50	31.61	24.69	20.56	12.45	9.90	8.74	8.12	7.76	7.54
9	87.38	45.61	31.72	24.81	20.69	12.58	10.05	8.89	8.28	7.93	7.72
9 1/4	87.49	45.72	31.84	24.92	20.80	12.71	10.19	9.05	8.44	8.10	7.90
9 1/2	87.60	45.83	31.95	25.03	20.91	12.84	10.33	9.20	8.61	8.28	8.08
9 3/4	87.71	45.94	32.06	25.15	21.03	12.97	10.48	9.36	8.78	8.45	8.26
10	87.82	46.05	32.17	25.26	21.15	13.10	10.62	9.52	8.94	8.63	8.44
10 1/4	87.93	46.16	32.28	25.38	21.27	13.24	10.77	9.68	9.11	8.80	8.63
10 1/2	88.04	46.27	32.40	25.50	21.38	13.37	10.92	9.83	9.28	8.98	8.81
10 3/4	88.16	46.38	32.51	25.61	21.50	13.50	11.06	10.00	9.45	9.16	8.99
11	88.27	46.49	32.62	25.73	21.62	13.64	11.21	10.16	9.63	9.34	9.18
11 1/4	88.38	46.61	32.74	25.84	21.74	13.77	11.36	10.32	9.80	9.52	9.37
11 1/2	88.49	46.72	32.85	25.96	21.86	13.91	11.51	10.48	9.97	9.70	9.55
11 3/4	88.60	46.83	32.96	26.08	21.98	14.04	11.66	10.65	10.14	9.88	9.74
12	88.71	46.94	33.08	26.19	22.10	14.18	11.82	10.81	10.32	10.06	9.93
12 1/4	88.83	47.05	33.19	26.31	22.22	14.32	11.97	10.98	10.50	10.25	10.12
12 1/2	88.94	47.17	33.31	26.43	22.34	14.46	12.13	11.15	10.68	10.43	10.31
12 3/4	89.05	47.28	33.42	26.55	22.46	14.60	12.28	11.31	10.85	10.62	10.50
13	89.16	47.39	33.54	26.66	22.59	14.74	12.44	11.48	11.03	10.97	10.69
13 1/4	89.27	47.50	33.65	26.78	22.71	14.88	12.59	11.65	11.21	10.99	10.88
13 1/2	89.39	47.61	33.76	26.90	22.83	15.02	12.75	11.82	11.38	11.17	11.07
13 3/4	89.50	47.72	33.88	27.02	22.95	15.16	12.90	11.99	11.56	11.36	11.26
14	89.61	47.83	33.99	27.14	23.07	15.30	13.06	12.16	11.74	11.54	11.45
14 1/4	89.72	47.94	34.11	27.25	23.19	15.44	13.22	12.33	11.92	11.73	11.64
14 1/2	89.93	48.06	34.22	27.37	23.31	15.58	13.38	12.50	12.10	11.92	11.83
14 3/4	89.94	48.17	34.34	27.49	23.44	15.72	13.54	12.67	12.29	12.10	12.02
15	90.05	48.28	34.45	27.61	23.56	15.87	13.70	12.84	12.47	12.29	12.21
15 1/4	90.16	48.39	34.57	27.73	23.68	16.01	13.86	13.02	12.65	12.48	12.40
15 1/2	90.27	48.50	34.68	27.85	23.81	16.15	14.02	13.19	12.83	12.67	12.59
15 3/4	90.38	48.61	34.80	27.97	23.93	16.30	14.18	13.36	13.01	12.86	12.78
16	90.50	48.73	34.91	28.09	24.05	16.44	14.34	13.54	13.20	13.04	12.97
16 1/4	90.61	48.84	35.03	28.20	24.18	16.59	14.50	13.71	13.38	13.23	13.17
16 1/2	90.72	48.95	35.14	28.32	24.30	16.73	14.66	13.89	13.56	13.42	13.36
16 3/4	90.83	49.06	35.26	28.44	24.43	16.88	14.83	14.06	13.75	13.61	13.55
17	90.94	49.17	35.37	28.56	24.55	17.02	14.99	14.24	13.93	13.80	13.74
17 1/4	91.05	49.28	35.49	28.68	24.68	17.17	15.16	14.42	14.11	13.99	13.93
17 1/2	91.16	49.40	35.61	28.81	24.80	17.32	15.32	14.59	14.30	14.18	14.12
17 3/4	91.27	49.51	35.72	28.93	24.93	17.47	15.49	14.77	14.48	14.36	14.31
18	91.38	49.62	35.84	29.05	25.05	17.61	15.65	14.95	14.67	14.55	14.51
18 1/4	91.49	49.73	35.95	29.17	25.18	17.76	15.82	15.13	14.85	14.74	14.70
18 1/2	91.60	49.84	36.07	29.29	25.30	17.91	15.98	15.30	15.04	14.93	14.89
18 3/4	91.71	49.96	36.19	29.41	25.43	18.06	16.15	15.48	15.23	15.12	15.08
19	91.82	50.07	36.30	29.53	25.56	18.21	16.32	15.66	15.41	15.31	15.27
19 1/4	91.93	50.18	36.42	29.65	25.68	18.36	16.49	15.84	15.60	15.50	15.46
19 1/2	92.04	50.29	36.54	29.77	25.81	18.51	16.65	16.02	15.78	15.69	15.65
19 3/4	92.15	50.41	36.65	29.90	25.94	18.66	16.82	16.20	15.97	15.88	15.85
20	92.26	50.52	36.77	30.02	26.06	18.81	16.99	16.38	16.15	16.07	16.04

Data Slip

Pocket for Data Slip

PULL

Monthly Mortgage Payment on a $1000 Mortgage					
8	20.21	12.06	9.48	8.28	7.63
8 1/4	20.33	12.19	9.62	8.43	7.79
8 1/2	20.45	12.32	9.76	8.59	7.96
8 3/4	20.56	12.45	9.90	8.74	8.12
9	20.69	12.58	10.05	8.89	8.28
9 1/4	20.80	12.71	10.19	9.05	8.44
9 1/2	20.91	12.84	10.33	9.20	8.61
9 3/4	21.03	12.97	10.48	9.36	8.78
10	21.15	13.10	10.62	9.52	8.94
10 1/4	21.27	13.24	10.77	9.68	9.11
10 1/2	21.38	13.37	10.92	9.83	9.28
10 3/4	21.50	13.50	11.06	10.00	9.45
11	21.62	13.64	11.21	10.16	9.63
11 1/4	21.74	13.77	11.36	10.32	9.80
11 1/2	21.86	13.91	11.51	10.48	9.97
11 3/4	21.98	14.04	11.66	10.65	10.14
12	22.10	14.18	11.82	10.81	10.32
12 1/4	22.22	14.32	11.97	10.98	10.50
12 1/2	22.34	14.46	12.13	11.15	10.68
12 3/4	22.46	14.60	12.28	11.31	10.85
13	22.59	14.74	12.44	11.48	11.03
13 1/4	22.71	14.88	12.59	11.65	11.21
13 1/2	22.83	15.02	12.75	11.82	11.38
13 3/4	22.95	15.16	12.90	11.99	11.56
14	23.07	15.30	13.06	12.16	11.74
14 1/4	23.19	15.44	13.22	12.33	11.92
14 1/2	23.31	15.58	13.38	12.50	12.10
14 3/4	23.44	15.72	13.54	12.67	12.29
15	23.56	15.87	13.70	12.84	12.47
15 1/4	23.68	16.01	13.86	13.02	12.65
15 1/2	23.81	16.15	14.02	13.19	12.83
15 3/4	23.93	16.30	14.18	13.36	13.01
16	24.05	16.44	14.34	13.54	13.20
16 1/4	24.18	16.59	14.50	13.71	13.38
16 1/2	24.30	16.73	14.66	13.89	13.56
16 3/4	24.43	16.88	14.83	14.06	13.75
17	24.55	17.02	14.99	14.24	13.93
17 1/4	24.68	17.17	15.16	14.42	14.11
17 1/2	24.80	17.32	15.32	14.59	14.30
17 3/4	24.93	17.47	15.49	14.77	14.48
18	25.05	17.61	15.65	14.95	14.67
18 1/2	25.30	17.91	15.98	15.30	15.04
19	25.56	18.21	16.32	15.66	15.41
19 1/2	25.81	18.51	16.65	16.02	15.78
20	26.06	18.81	16.99	16.38	16.15

PULL

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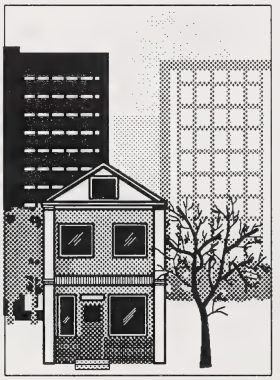

Monthly Mortgage Payment Calculator

Interest Rate %

Amortization Period (in years)

5 10 15 20 25

cut out windows

for a $1000 mortgage

A.

D.

L.

C.

Just match up the interest rate and the amortization period. The monthly payment for a $1000 mortgage will be shown in the window.

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Mathematics 33

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L.R.D.C.
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